BEFORE THE ODISHA ELECTRICITY REGULATORY COMMISSION
BIDYUT NIYAMAK BHAWAN
PLOT NO 4, CHUNUKOLI, SHAILSHREE VIHAR
BHUBANESWAR 751021

IN THE MATTER OF: Application for approval of Capital Investment Plan for the FY 2021-22 in the Licensed Area of TP Central Odisha Distribution Ltd ("TPCODL").

And

IN THE MATTER OF: TP Central Odisha Distribution Ltd. (Formerly CESU), 2nd Floor, IDCO Tower, Janpath, Bhubaneswar- 751 022 represented by its Chief Financial Officer.

…. Applicant

1. Background for Submission of the Petition

The Hon'ble Commission in order of Case No 11/2020 ("Vesting Order") had directed TPCODL to seek the approval of the Capital Expenditure Plan in line with the regualtions. The extracts from the Vesting Order are as follows:

42. Capital investment plan

> *(e) TPCODL would be required to seek the Commission's approval on the detailed capital expenditure plan in line with the regulations. TPCODL shall satisfy the Commission that the capital expenditure plan submitted in line with regulations adheres to the capital expenditure plan submitted as part of the Bid.*

Similarly even the Odisha Electricity Regulatory Commission (Terms and Conditions for Determination of Wheeling Tariff and Retail Supply Tariff) Regulations 2014 "Tariff Regulations" provide the following for approval of the Capital Investment

> 7.34 The licensee shall propose in its filing a detailed capital investment plan. The plan must separately show ongoing projects that will spill into the year under review and new projects that will commence but may be completed within or beyond the tariff period. For the new projects, the filing must provide the justification as stipulated under relevant investment guidelines of the Commission.

In compliance of the Vesting order and also the Tariff Regulations , we had filed the proposal for approval of the Capital Expenditure in FY 2020-21 under Case No 32 of 2020in July 2020. The

Hon'ble Commission in their order dated 8th September 2020 passed the order in the matter and approved certain quantum of Capex. The Capital Expenditure for FY 2020-21 is under progress in TPCODL. The Status of the capital expenditure is explained in this submission.

We are in this submission filing the proposal for Capital Investment for FY 2021-22 for the approval of the Hon'ble Commission. We are also seeking an approval of the Hon'ble Commission to permit carrying forward the capital expenditure of FY 2020-21 to FY 2021-22. The details are as given in the following paragraphs

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1 Capital Investment/Expenditure Proposal for FY 2020-21

1.1 Need for Capital Expenditure

TPCODL receives electrical power at 33KV level from 51 numbers of 220/33KV or 132/33KV transmission substation located within and in the vicinity of TPCODL operational area. TPCODL distributes the power at 33KV / 11KV / 440V / 230V depending on the demand of the consumers.

One of the major challenges for TPCODL is the present network condition at some locations which are not compliant to statutory guidelines and pose threat to safety of employees, public at large and animals.

The 33 kV overhead lines are long, radial with undersized, worn out bare conductor having extremely long spans, having damaged, bent, tilted poles, poor joints, compromised safety clearances, and non-availability of guard wires in MV overhead feeders. Network therefore needs urgent investment to address the operational, commercial, and safety related challenges to improve the reliability of supply, customer services, and safety of staff, general public, and animals.

As explained in our earlier petitions, TPCODL has identified a number of challenges related to Safety, 33KV/11KV/0.415KV network, Metering infrastructure, Customer Services, and Technology usage. These challenges are planned to be addressed through a systematic investment plan prepared by TPCODL, a part of which was proposed by TPCODL for FY 2020-21 in the petition filed in Case No 32 of 2020.

Tata Power has also been an early implementer of latest technology in India and has perhaps most number of standalone and integrated technology platforms in use. These technologies have been instrumental in improving the overall performance of the company and also been able to deliver business benefit in terms of lowering losses and improving reliability and better management of the business and consumers.

TPCODL considers customers as the most important stakeholder and has prepared its strategy to create value for the customers by improving the reliability of supply for better customer experience Capex intervention is required to reinforce the network so as to enhance the useful life of assets and bring in new technology.

The proposed Capex plan represents a justified and efficient level of total capital investment estimated by TPCODL to meet the service obligation; ensuring safe and reliable network, maintaining high level of service standards and to reflect upon the commitment of benchmark customer services through process improvement, capacity building and technology adoption.

1.2 Summary of the Capital Expenditure

TPCODL in line with the philosophy adopted for FY 2020-21 has considered Capital Expenditure under five different heads viz a) Statutory and Safety b) Loss Reduction c)Reliability d) Load Growth and e) Development of Infrastructure. Further, based on the study, it has also broken the capital expenditure under three heads viz (i) Schemes with a Road Map (i.e schemes which would require more than one year to complete (ii) Schemes other than those with a Road Map and (iii) Unplanned Capex. The summary of the Capex planned for FY 2021-22 (only Hard Cost i.e without considering Employee Costs capitalized and Interest During Construction) is as summarized below

Table 1-1Capital Expenditure Proposal Summary for FY 2021-22 (Hard Cost)

S. No.	Major Category	Activity	Remarks	Capex Requirement	Capitalization
				(In Cr.)	(In Cr.)
A	Statutory & Safety	Equipment enhancing Safe Work Environment		5.50	4.5
		Installation / Construction of Plinth fencing or Boundary wall of DSS or GSS. Area development wherever substation		7.00	5.0
		Development of Meter Testing Lab and its Accredetion		2.82	0.5
		DSS refurbishment		12.01	8.50
				27.3	**18.5**
B	Loss Reduction	Old Electromechanical Meter and Defective Meters replacement		113.04	79.13
		Smart Meter Implemenation	Scheme with a Road Map	54.97	38.479
		Infrastructure for spot billing & spot collection.		3.55	3.55
		Equipment like Accucheck, CMRI, Digital Camera etc		0.92	0.92
		LT O/H Bare to LT AB Cable conversion		19.01	12.00
				191.49	**134.08**
C	Reliability	SCADA implementation	Scheme with a Road Map	31.00	14.36
		GSAS Implementation		35.11	17
		33KV and 11KV Sick Equipment Replacement		15.48	8
		33KV System Improvement schemes - Feeders and Power Evacuation from OPTCL		40.06	21
		33KV System Improvement schemes - Equipment like 33KV RMU, Isolators etc		9.67	8.00
		11KV System Improvement schemes - Feeders and Equipment like RMU, ACB, MCCB, AB Switches, Mobile DT ,Earthing etc		21.93	8.00
		Distribution transformer augmentation		7.50	7.00
				160.75	**83.36**
D	Load Growth	Meter Installation for all new connection		23.47	22.00
		Network Extension to release New Connection		20	14
		Addition / Augmentation of Power Transformers		15.25	12
				58.72	**56.00**
E	Infrastructure	Infrastructure for Customer Care , Call Centre , Payment Centre and Section Offices		5.00	5.00
		IT & Technology for process efficiency & enhanced productivity.		38.41	15
		Implementation of GIS Roadmap	Scheme with a Road Map	26.78	18
		Augmentation of Communication Network in TPCODL Area	Scheme with a Road Map	10.46	4.00
		Transformer Repairing Workshop		7.00	3
		Central Store development		5.00	3.5
		Civil Upgradation		14.8	12
		Ready to Use assets for Offices		2.25	2.25
				109.69	**62.75**
F	Other	**Unplanned Capex**		**20.00**	**20**
		Grand Total (A+B+C+D+E+F)		**567.98**	**374.69**

1.3 Schemes with a Road Map

Since the time of commencing the operation on 1st June 2020, TPCODL has been planning Road Map for scheme in the area of Information Technology, Automation, Metering and Communication. Such Road Map involves spacing the capital Expenditure over a longer period of time of say 3 years with a base expenditure in the first year. The schemes with a road map are follows:

a. Implementation of Geographical Information System (GIS)
b. Implementation of Smart Metering System

c. Commissioning of SCADA in the entire area of TPCODL
d. Augmentation of Communication Infrastructure in TPCODL

It is submitted that as regards the implementation of GIS and Smart Metering Systems, TPCODL has in petition dated 9th November 2020 (also named Case No 32 of 2020) presented the DPRs and the same is under consideration with the Hon'ble Commission. For the purpose of continuity, we are once again presenting the same in this submission.

The phasing of the Capital Investment with a road map is as follows

Table 1-2 Capital Expenditure Phasing for Schemes with Road Map (Rs Cr)

Sr No	Particulars	FY 2020-21	FY 2021-22	FY 2022-23	FY 2023-24	Total
1	GIS Implementation	9.42	26.78	16.59		**52.79**
2	Implemenation of Smart Metering System	50	54.97	66.03	80.99	**251.99**
3	Implementation of SCADA System		31	75	23	**129.00**
4	Installation of New Communication System		10.46	21.12	17.88	**49.46**
	Total	**59.42**	**123.20**	**178.74**	**121.87**	**483.24**

While the DPRs have been attached along with this submission for such schemes, a brief description is as given below

1.3.1 Implementation of Geographical Information System

Tata Power's competence in adaptation of latest technology makes it very appropriate to take initiative to lead conceptualization and implementation of state of the art automation technologies in TPCODL. In this pursuit, TPCODL proposes to implement GIS which is an enterprise software application that maintains the locational and physical attributes of electric infrastructure overlaid on the geographic, political, property and other real-world features. The system is used throughout the Utility as the source of infrastructure information. The system keeps track of electric delivery networks and all of the elements that comprise those networks.

1.3.1.1 Present implementation of GIS

TP Central Odisha Distribution Limited (TPCODL) is a joint venture between Tata Power and the Government of Odisha with the majority stake being held by Tata Power Company (51%). TPCODL serves a population of 1.36 Crore with Customer Base of 26 Lakh and a vast Distribution Area of 29,354 Sq. Km.

Under RAPDRP Part A project, only 1.6% area of TPCODL has been covered and approximately 4.38 lakhs consumers has been mapped for 12 isolated towns. However the following things has not been covered after implementation of RAPDRP Part A

- Software License AMC
- Data Sustenance of 12 Towns - 428 Sq. Km from year 2018
- Mobile Application for Capturing of Data
- Sustenance Process & Integration with Mobile Application
- 98% of TPCODL area (Rural, Part of Urban & Smaller Towns)
- Utility Specific Integration

1.3.1.2 Future Requirement and Plan

GIS is going to help immensely in increasing the operational efficiency of TPCODL as well as help in providing the reliable electricity supply, reduce the AT&C loss which ultimately leads to Customer Satisfaction.

Under GIS implementation plan following activities will be done.

- Entire TPCODL will be mapped in GIS in phased manner covering Land base, Network and Consumer Indexing & its Pole painting.
- Energy Audit of Entire Circle at 33 kV and 11 kV Level to identify the key areas of Losses.
- Feeder Wise Load Flow Analysis of all the DTs for Load Balancing.
- Mapping of all DT & its Connected Consumers and pole painting at LT Level to identify the untraceable consumers missed from billing fold.
- Spatial patrolling interface for cable network with Route tracking and Route Tracking and field data collection app
- To locate all lines / cables which will help the line man / engineers to attend the faults speedily and reduce the outage time.
- GIS and SAP-PS integrated workflow platform for new distribution project designs leading to accurate estimation and proper expenditure.
- Monitoring the complete progress of the project, from planning to commissioning, on the GIS integrated platform.
- Planned outage information for customer on Customer Portal
- Integration with different applications will be done to automate the different process, which will save time and effort of employees. Integration touch points can be detailed out as per users' requirements.

1.3.1.3 Phasing of Expenditure for GIS Implementation

The phasing of the expenditure is as follows:

Table 1-3 Phasing of GIS Implementation

Sr No	Particulars	FY 21	FY22	FY 23
1	Areas Covered	1. 33/11 kV S/S and Its Network - Entire TPCODL Area 2. Consumer Indexing of Bhubaneswar Circle I Starting from it's originating 33/11 kV S/S & Asset Painting 3. All Administrative Boundaries of TPCODL Section -> Sub Division -> Division -> Circle -> TPCODL	1. 11kV Network - Entire TPCODL Area 2. Consumer Indexing of Bhubaneswar Circle II and Cuttack Circle Starting from it's originating 33/11 kV S/S & Asset Painting	1. Entire Consumer base of Dhenkanal & Paradeep Circle Starting from it's originating 33/11 kV S/S & Asset Painting
2	Scope of Work	Basic Infrastructures: Plotter, Work Stations, Mobile Data Collector App	Server Upgradation, ESRI License Upgradation & Re-Configuration & Integration with other modules	Fully integrated E-GIS system (ADMS, Sustained GIS)
3	**Capital Expenditure (Rs Cr)**	**9.42**	**26.78**	**16.59**

The details of the project are given in **Chapter 2 DPR for Implementation of Geographic Information System (GIS)**

1.3.2 Commissioning of Smart Metering System

Smart meter is an advanced energy meter that measures the energy consumption of a consumer and provides added and timely information to the utility company compared to a regular energy meter. Smart meters can read real-time energy consumption information including the values of voltage, phase angle, the frequency & tamper events and communicates bi-directionally on real time basis. Smart meters can communicate and execute control commands remotely as well as locally. It has integrated two-way communication modules to facilitate data communication. Need and benefits of the implementation of smart metering is explained in the subsequent paragraphs.

Due to rapid increase in human population in urban area, the demand of electricity has increased, causing increasing power purchase costs during peak hours. Energy conservation has great significance in this scenario of increasing electrical energy demand. Accurate metering, detection of illegal activities, implementation of proper tariff and billing system, timely revenue collection are necessary to ensure economical functions of distribution utility.

Smart meters with Automatic Meter Reading (AMR) system will address the problems of manual collection of meter data, energy deficit during peak hours and opens a channel for the consumers to participate in energy conservation by two-way communication between utility and consumer.

Objective of this scheme is to rollout smart metering infrastructure in TPCODL license area and to have a better control on revenue generation and revenue protection.

To reduce AT&C losses and to ensure revenue from high end consumers, it is proposed to install Smart Meters in consumer with consumption >= 300 units, DTs of rating >=100KVA and all new connections in which three Phase meters are to be installed from FY 21-22 onwards, though the IT Infrastructure required would be implemented in FY 2020-21 itself.

1.3.3 Broad Scope of work

TPCODL has proposed to install smart meters for its consumers in phased manner. This DPR covers all the activities required for implementation of smart metering for TPCODL consumers. Broadly it includes:

a) Replacement of traditional meters by Smart meters having connect / disconnect features including prepaid features.
b) HES and Communication Infrastructure
c) Meter data management software and integration with SAP.
d) Data Analytic system.
e) Back-end IT infrastructure.

1.3.4 Phasing of Work and Expenditure

The capex is phased over the period from FY 2020-21 to FY 2023-24 and the total meters to be installed are as under

Table 1-4: Number of Meters to be installed

Period	Meters to be covered	Capex required
	Count	Rs. Cr
FY 2020-21	Only IT Expenditure	115
FY 2021-22 (Meter & IT setup)	80000	
FY 2022-23	80000	67
FY 2023-24	90000	70.23
Total	**250000**	**252.23**

Table 1-5: Breakup of Capital Expenditure and Phasing (Rs Cr)

	FY 21	FY 22	FY 23	FY 24	Total
IT Infrastructure	50.0				50.0
Meter Costs		50.4	61.0	68.8	180.2
SAP Integration Cost			5.0	5.0	10.0
Training		2.0			2.0
Cost of Tools and PPE		2.6			2.6
Contingency				7.2	7.2
Total	**50.0**	**55.0**	**66.0**	**81.0**	**252.0**

The details of the project are given in **Chapter 3 DPR for Smart Meter Implementation**

1.3.5 Implementation of SCADA System

1.3.5.1 Existing SCADA System

The existing SCADA system is implemented under R-APDRP (Part-A) and designed for 60 and 44 nos. of Sub-station at Bhubaneswar and Cuttack respectively. However, with Phase 1 and Phase 2 of "SCADA Deployment Plan", the existing SCADA System will handle 110 nos. of Sub-stations, which will exhaust the current capacity of the systems installed.

In addition to 110 nos. of substations, we require to integrate additional 261 nos. (Appx.) 33/11 kV Sub-station. Thus, the existing SCADA System needs to be augmented for 500 nos. of Substation instead of 110 nos. of Sub-stations. It is imperative that required number of Input / Output Signal counts will increase, and the existing SCADA System does not have sufficient capacity to accommodate another 261 nos. of Sub-station and addition of future sub-stations. To meet this requirement existing SCADA System needs up gradation of Hardware and Software license with existing functionalities. Similarly, the existing SCADA System of Puri, which was supplied by Schneider, will also require up gradation to meet the growth plan in that area. Limitation of the Existing SCADA Systems are following:

- Multiple System i.e. independent system at Bhubaneswar, Cuttack and Puri
- Standalone System at each control centre
- No data exchange between the system
- The upgradation may require new SCADA software version, which may also require latest hardware considering compatibility and capacity
- Independent Data exchange with enterprise level system and with other utilities (SLDC, OPTCL)
- Independent inventory and maintenance practices
- Operation and Maintenance resource development for each system. Restrict the optimization of resources.
- Cyber Security risks compounded due to distributed architecture with multiple system and interfaces at each Control Centre.
- Dependency on the existing system providers.
- Upgradation cannot be done by any other agency than OEM. This will not provide opportunity to save the cost through open tendering as it will be a single party order.

1.3.5.2 Deployment of New SCADA System

Currently there is no concept of Centralised Power System Control Centre or Area Power System Control Centre in TPCODL, as a centralize agency to monitor the network and coordinate the

network operations in real-time. There is a strong need to setup the Centralised Power System Control Centre along with Area Power System Control Centre to coordinate the network operations in real-time by implementing state of the art technologies available in the market for distribution network.

In view of Centralised Monitoring and Control of the entire distribution network, it is proposed to replace the existing SCADA System to cover the entire TPCODL distribution network covering all the 5 circles i.e. Bhubaneswar-I, Bhubaneswar-II, Cuttack, Dhenkanal and Paradeep comprising of 371 nos. of 33/11 kV Primary Sub-Stations.

The purpose and necessity for replacing the existing SCADA system is as follows:

- **Architecture of existing SCAA**

The existing SCADA Systems architectures are of standalone type and monitoring & controlling their respective substation present in each town. The existing SCADA System functionalities are limited and designed as per the Model Technical Specification (MTS) of R-APRDRP. Moreover, there is no concept of MCC and BCC.

- **License Enhancement**

The existing SCADA System do not have sufficient capacity to accommodate another 261 nos. of Sub-station or all sub-stations of TPCODL. So, for enhancing the scope, the SCADA System needs upgradation of Hardware and Software license, to meet the performance parameters for real-time CPSCC monitoring and operations.

- **Aged Hardware and Software**

Typical life of IT hardware and software is about 5 to 7 years. The existing SCADA System hardware is around 4 years and is going to be obsolete in a year or two. The aged hardware is resulting in frequent failures. The repairing & replacing of the defective part has become difficult day by day with no support from OEMs. The failure of hardware results in impairment of OS & SCADA applications and functionalities.

Further, the Operating System (OS) of Servers and Workstations, SCADA Software have reached their End of Life (EOL). In case of malfunctioning of the software or removal of bug for normalcy and patch updating, it has become very difficult which impacts impairment of SCADA applications and functionalities.

With this objective of ensuring reliable power supply and ensuring best customer services to the end consumers, TPCODL has come up with capital investment addressing the following major functional requirement:

a. Centralized System for visibility of the entire distribution network.
b. Enables standardized Data Acquisition and Reporting.

c. Perform all critical system operations including routine and emergency operations with enhanced operational availability of distribution network and reliable power supply to customers.
d. Predictive and Analytical tools for efficient management and decision making for the entire distribution network.
e. System supporting Cyber Securities management through Centralized Account Management, domain controller, IPS & IDS, User Authentications, Network Segmentation, Access Control, Route and Traffic Control, Implementation of Trust Boundaries, OS upgradation, patch management of application and OS, monitoring of real-time alert of compromise and potential compromise

The Centralized System will provide common training platform for systems and maintenance of assets.

a. Enhanced Operational safety.
b. Implementation of adequate Network Management and Cyber Security measures.
c. Database generation, preparation for entire network centrally, causing standardization across network.

1.3.5.3 Capex Plan

TPCODL proposes for additional Capital Expenditure Rs 129 Cr. in phased manner i.e.

- Deployment of New SCADA System with the concept of MCC and APSCCs.
- Monitoring and Control of 371 nos. of Sub-stations with the new proposed SCADA System.
- RTU installation, Commissioning & Testing to monitor As-Is condition of Conventional type Sub-station

The above-mentioned Capital Expenditure does not include any cost towards Civil Building and GSAS refurbishment works.

Table 1-6 Summary of Capex from FY 2021 -22 to FY 2023-24

Phases	Phase # 1	Phase # 2	Phase # 3	Total Cost with Taxes (GST 18%)
	FY 21-22	FY 22-23	FY 23-24	
Scope of Work	Deployment of New SCADA System to set up MCC and APSCCs	a. Deployment of New SCADA System to set up MCC & APSCCs b. RTU Installation, Commissioning & Testing of 90 Nos. of Conventional type substation for As-Is SCADA Monitoring	a. RTU Installation, Commissioning & Testing of 105 Nos. of Conventional type substation for As-Is SCADA Monitoring	
Breakup of Capital Expenditure (Rs Cr)				
SCADA	20	53	0	73
RTU (As-IS) For Conventional S/s	4	15	23	42
RTU for GSAS S/S	7	7	0	14
Total Cost	31	75	23	**129**

The details of the project are given in **Chapter 4 DPR for Deployment of New SCADA System for TPCODL Network**

1.3.6 Installation of New Communication System

As on date, In TPCODL there are approx. 377 nos. of office locations and Approx. 350 nos. of grid sub stations. Following are the connectivity details implemented through RAPDRP –Part A of SCADA and IT implementation.

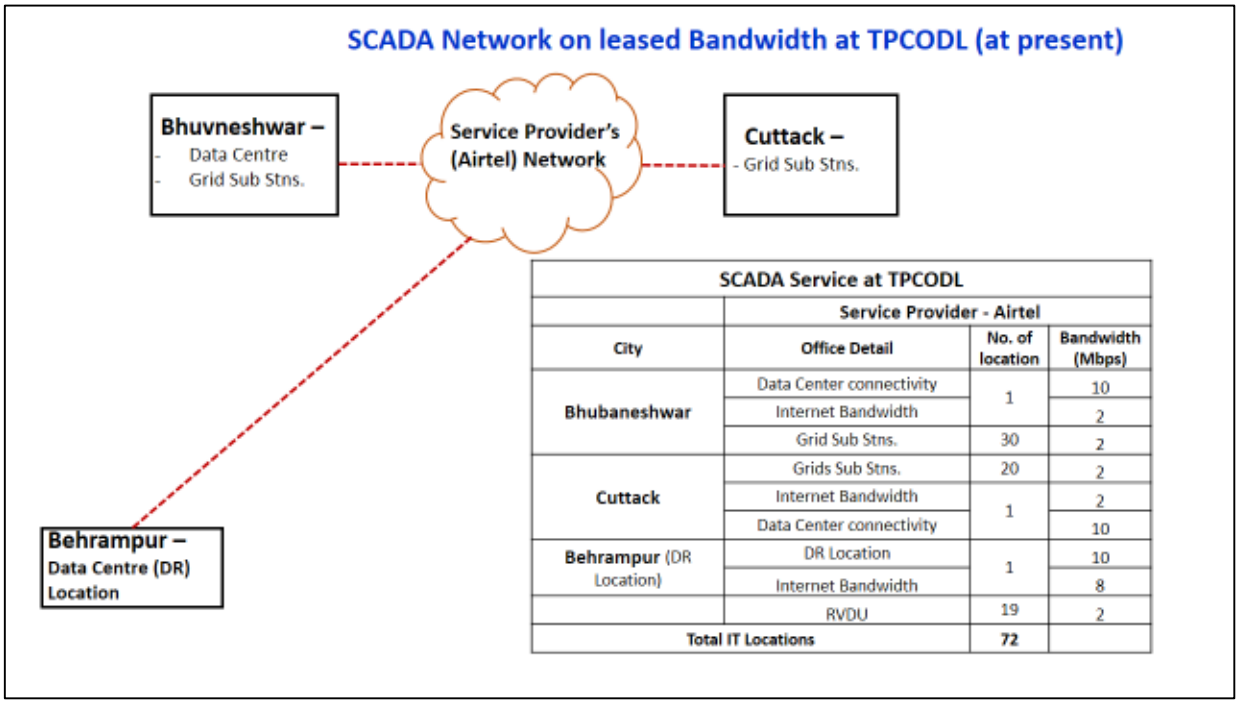
1.3.6.1 Under RAPDRP Part A – SCADA

M/s DFE has executed SCADA project in TPCODL and there is tripartite agreement between TPCODL, M/s DFE and M/s Airtel for communication establishment.

- 71 nos. of grids (30 at Cuttack and 41 at Bhubaneshwar) are connected through 2 Mbps MPLS links provided by M/s Airtel .
- There are separate control centers set up for SCADA at Bhubaneshwar and Cuttack which have 10 Mbps of MPLS VPN link and 2 Mbps of internet link.
- 448 No.s (242 in Cuttack and 206 in Bhubaneshwar) of FRTU/FPI are connected through GPRS .
- DFE has also installed DC routers at all RAPDRP grids.
- 5 grids at PURI town are connected through TPCODL owned OFC (24 F) approx... 25Km. and have separate control center. Project was executed by L&T/Schneider.

The schematic is as provided in the figure below

Figure 1-1 Schematic of existing SCADA Network



SCADA Service at TPCODL			
	Service Provider - Airtel		
City	Office Detail	No. of location	Bandwidth (Mbps)
Bhubaneshwar	Data Center connectivity	1	10
	Internet Bandwidth		2
	Grid Sub Stns.	30	2
Cuttack	Grids Sub Stns.	20	2
	Internet Bandwidth	1	2
	Data Center connectivity		10
Behrampur (DR Location)	DR Location	1	10
	Internet Bandwidth		8
	RVDU	19	2
Total IT Locations		72	

1.3.6.2 Under RAPDRP PART A – IT

M/s L&T has executed RAPDRP –IT project in TPCODL with M/s Vodafone as Primary Service provider and M/s Airtel as secondary service provider for communication establishment. LOA has been awarded in 2018 for 5 years validity with appropriate termination clause.

- 68 nos. of offices (45 at Bhubaneshwar and 23 at Cuttack) are connected through 2 Mbps of MPLS link to DC
- DC set up at Bhubaneshwar with 8 Mbps of MPLS link and 10 Mbps of internet link.
- Customer Call Center at Corporate office is connected through 4 Mbps of MPLS VPN link.
- 20 Mbps of DC-DR replication link established.
- Approx. 9200 nos. of DT/HT meters connected through GPRS for energy metering.

Summary of the Communication Infrastructure deployed at TPCODL is as below:

Table 1-7: Present Communication Infrastructure

City	Office Detail	Primary Service Provider - Vodafone		Secondary Service Provider – Airtel	
		No. of location	Bandwidth (Mbps)	No. of location	Bandwidth (Mbps)
Bhubaneswar	Data Center connectivity	1	8	1	4
	Internet Bandwidth		10		4
	DC- DR replication link		20		10
	Customer care	1	4	1	4
	Circle offices	1	2	1	2
	Divisions	3	2	3	2
	Subdivision offices	8	4	8	4
	Sections	37	2		
	Internet Bandwidth for Scada	1	10		
	Grid Sub stations	30	2		
Cuttack	Circle offices	1	2	1	2
	Divisions	2	2	2	2
	Sub Division	7	4	7	4
	Sections	16	2		
	Internet Bandwidth for Scada	1	2		
	Grid Sub stations	22	2		
Berhampur (DR Location)	DR Location	1	8	1	2
	Internet Bandwidth		8		4
	RVDU	19	0		
Puri	Control Center for scada	1			
	Grid Sub stations	5	10		
Total IT Locations		**157**		**18**	

The services of communication deployed is not effective and need upgradation depending upon the requirements for reliable communication as communication is backbone for effective implementation of technology and providing better services to the services.

1.3.6.3 Requirements:

Communication requirement is to support core corporate functions in (a) system operations, protection, maintenance and outage recovery, (b) customer service, accounting and billing, (c) workforce development and training. The introduction of latest communications infrastructure will enable utility to capture corporate goals, achieve organizational effectiveness and process innovation. Such initiatives have witnessed a turnaround for effectiveness, efficiency and commitment to aspire for excellence journey.

There is no connectivity provisioned at rest of the offices however, on piecemeal basis, Broadband/4G Dongle is available with monthly plans to some extent but this is not sufficient for connecting offices in effective way. To provide better services to the consumer, it is required to have robust communication network in offices so that efficient services to consumer can be

provided using various technology intervention. In view of this, it is required to extend communication of enterprise services to the following locations:

Locations identified for extending Enterprise services are as follows:

Table 1-8: Locations identified for extending services

Location	No
Circle Offices	5
Divisional Offices	20
Sub divisional Offices	65
Section offices and Commercial Offices	247
Total	**337**

Table 1-9 :Break up of Locations:

S.No.	Town	Area in Sq. Km	Consumer base	No. of Grid S/stns.	No. of offices locations	
1	Cuttack	64	151550	22	34	(CO-01,DO-02,SDO-07,SEC-24)
3	Puri	30	50000	6	13	(DO-01,SDO-03,SEC-08,SCADA CONTROL ROOM-01)
4	Dhenkanal	30.56	14878	3	5	(CO-01,DO-01,SDO-01,SEC-02)
5	Angul	19.8	19600	1	4	(DO-01, SDO-01, SEC-03(no1,no2,no3))
6	Khurda	25.64	11500	1	6	(DO-01,SDO-01,SEC-04)
7	Kendrapara	10.77	13950	1	7	(DO- 01 No, SDO- 01, SDO- 03, MRT Office- 01, Energy Police Station-01)
8	Nayagarh	15.54	9500	1	4	DO-01, SDO-01,SEC-02)
9	Jagatsinghpur	20	8000	2	4	(DO-01,SDO-01,SEC-02)
10	Bhubaneswar	135	360491	22	48	(CO-02,DO-03,SDO-08,SEC-35)

1.3.6.4 Communication architecture Criteria:

Communication Infra/technologies for consideration

- **Media:** U/G, O/H Fiber/ Lease Line B.W /Telecom Service Provider (TSP) /Microwave.
- **Technologies**: VPN IP-MPLS B.W/ P2P Lease Links/ Public LTE network /L3 switching/Wireless WAN.
- **Security:** NGE (network group encryption).
- **iNMS**: Integration of all active components for Centralized monitoring.

Design criteria for critical-communication networks

- **Flexibility:** Enables and adapts to new application
- **Scalability:** Handles increased bandwidth demands in efficient and cost effective way
- **Predictability:** Manages and enforces service quality controls, provide high resiliency
- **Security:** Protect the network with security-by-design, and encryption
- **Simplicity:** Management tools that use industry speaks to accelerate technology adoption and reduce TCO
- **Resiliency:** Designed for no single point of failure at the network nodal level; multi-failure recovery
- **CAPEX/OPEX:** Consideration of upfront cost required for Communication network set-up and specific to support particular applications as well as availability/presence of other service providers
- **Short Term/Long term:** Communication infra requirement as per the Business requirements (immediate & future) as well as Technology roadmap of TPCODL considering Bandwidth, Latecy, scalability etc.
- **Circle/State Level:** Communication requirement specific to a particular Circle considering geographic and demographic conditions as well consider building a umbrella communication network across TPCODL

Following factors were considered while evaluating Communication technology to be implemented at TPCODL.

- Existing Communication Infra
- Consumer base and spread
- TPCODL locations and spread
- Feasibility of creating Utility own infrastructure
- Presence of Telecom Service Providers
- Environmental Condition
- Bandwidth requirements

Based on options available, the proposed Communication network can be created with 3 types of category as mentioned below:

Category 1: Connectivity between Circle offices :This can be achieved by:

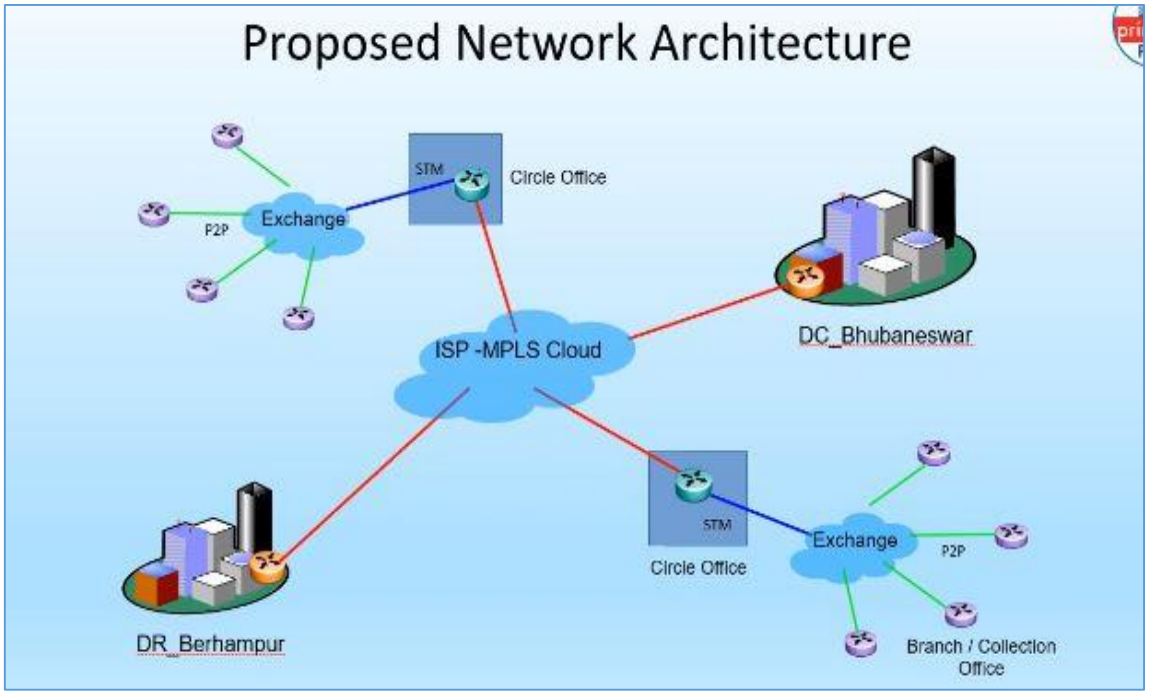
- Taking leased OFC/OPGW pair or bandwidth from TSP's, thus forming ring
- MPLS VPN links from TSP's terminating from Circle office (aggregator node) to Data Center, in full mesh architecture

Category2 : Within Circles : Deploying MPLS VPN links directly from site to DC, in full mesh architecture (157 sites already connected through MPLS VPN links with 2 Mbps capacity against required capacity of 10 Mbps.

- Connect clusters of Offices, Grid sub-stations which are in close vicinity through Point to Point Leased Links or laying O/H OFC over electricity poles. Backhaul to the Circle office (aggregator node) through MPLS VPN links from TSP
- Point to Multi Point Microwave links between the locations for far-off locations in specific areas. Backhaul to the aggregator node through MPLS VPN links from TSP (excluding Bhubaneswar) and till the time OFC network is not laid. For Bhubaneswar, it is proposed to start building network using O/H OFC only.
- In long term, TPCODL shall make a practice to lay U/G OFC along with Power cables for having connectivity with Sub Stations/ Offices.

Category 3: Within Locations : For Division/Sub-divisions; P2P Links from Broadband service providers or O/H OFC links will terminate at IP-MPLS switching equipment / L3 switches to form Access rings. L2 switches will be used for service distribution to local users.

Figure 1-2 : Network Architecture:



Source: Print link CC Orissa

All Circle offices would be connected through MPLS Network across the Districts (Khurda, Cuttack, Puri, Paradip & Dhenkanal) of Odisha.

DC at Bhubaneswar & DR at Berhampur (temporary) would be connected through MPLS Network.

All Branch / Collection Offices would be connected through Point-to-Point Lease Line /OFC Network.

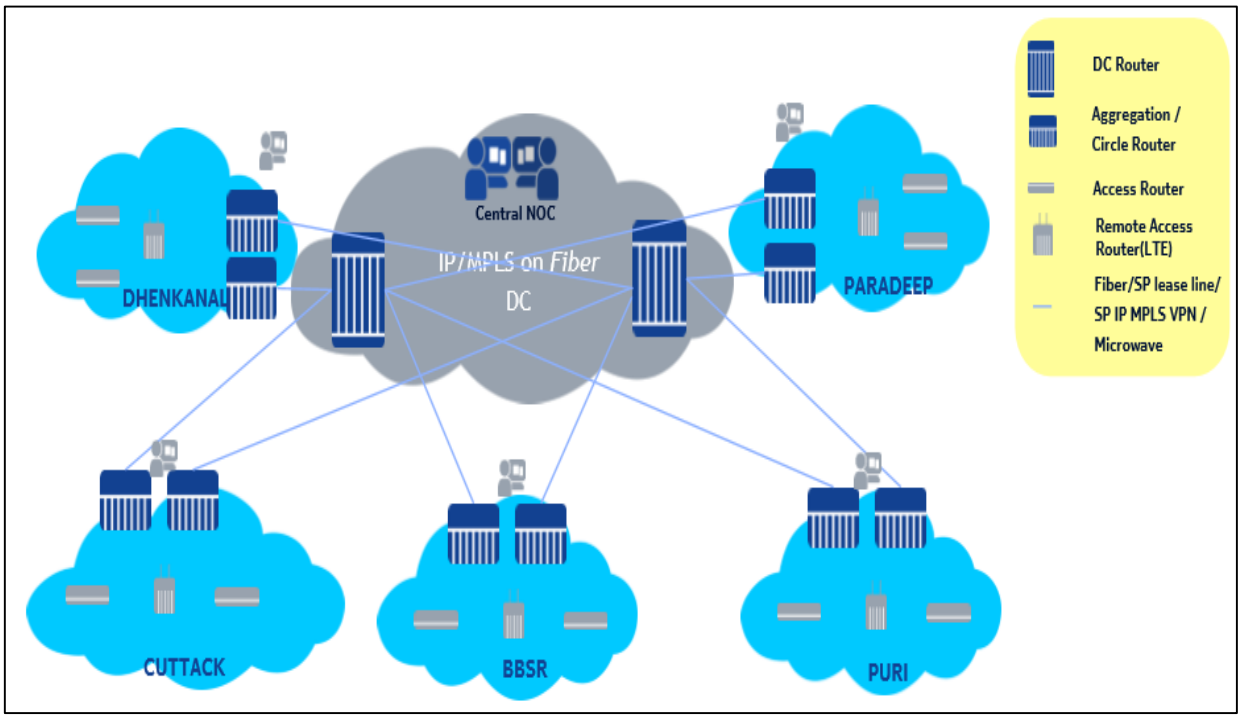
Security: NGE (network group encryption) encryption solution that enables end-to-end encryption of MPLS services, Layer 3 user traffic, and IP/MPLS control traffic for maximum availability and uncompromising security and protection of any traffic in the mission critical IP/MPLS/carrier leased line as well as wireless network (4G, LTE) network.

iNMS: Integration of all active components for Centralized monitoring

- **Connectivity at Equipment level:**

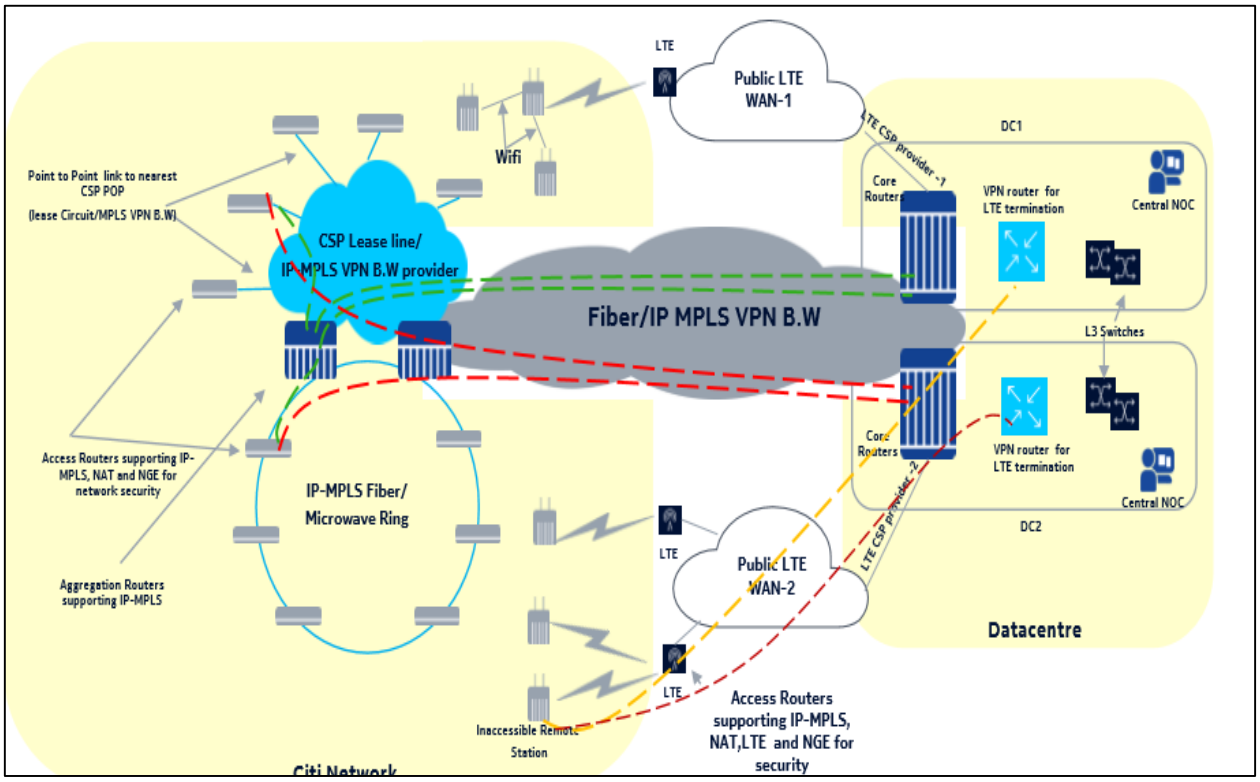
Ethernet routers supporting services like SCADA, L2 (Ethernet) / L3 (enterprises), IP-MPLS VPN, Multicast etc. will be connected on 1Gbps Ethernet ports in a ring or to communication service provider on VPN bandwidth as per feasibility and availability of media which can be Fiber/copper or radio links. All router traffic will be terminated to Aggregation Routers at circles.

Figure 1-3 Connectivity at Equipment Level



Source: Nokia

Figure 1-4 Connectivity across TPCODL



Source: Nokia

Ethernet routers supporting services like SCADA, L2 (Ethernet) / L3 (enterprises), IP-MPLS VPN, Multicast etc. will be connected on 1Gbps Ethernet ports in a ring or to communication service provider on VPN bandwidth as per feasibility and availability of media which can be Fiber/copper or radio links. All router traffic will be terminated to Aggregation Routers at circles.

Aggregation router will have Access router terminated on 1G ring (fiber, copper or Radio) or CSP will provided aggregate throughput on 1G or10G ports. Aggregation router will be connected to central core routers on 1G or 10Gbps uplink based on bandwidth requirement and CSP feasibility DC Core & VPN Router.

Remote locations can be connected through 4G LTE using Wireless WAN with last mile connectivity at DC firewall.

Cost estimation for MPLS & Point-To-Point circuits will differs with available service providers in different circles across TPCODL.

1.3.6.5 Capital Expenditure

For cost calculation, we have made following assumptions:

- Distance between offices approx. 2 -10 KM (average distance in Bhubneswar & Cuttak is 4 Km), Bandwidth allocated to (Circle, Division & Sub division -10 Mbps, section offices – 4 Mbps) and aggregated bandwidth at aggregator is 50 Mbps; Circle office to data center 100 Mbps
- 300 MBps MPLS VPN link between Data Centers (2 nos.)

On the basis of the above, the breakup of the capital expenditure is as follows:

Table 1-10 :Break up of Capital Costs:

MPLS VPN Leased links from TSP and Aerial OFC through Poles										
S.No.	Link Details	Bandwidth (Mbps)	No. of Link	Unit Rate (OTC)	Uniot rate (ARC)	Year 1		Year 2		
						60	60	150	150	
						CAPEX (Rs. In Lacs)	OPEX (Rs. In Lacs)	CAPEX (Rs. In Lacs)	OPEX (Rs. In Lacs)	O (R La
Connectivity of Data Center & Circle Offices (Through IP/MPLS Link)										
1	IP/MPLS Leased Link between DC & DR	300	2 (Primary + Backup)	1.2	14	2.4	28			
2	IP/MPLS Leased Links from Circle office (5 Nos.) with Data Center (DC+DR)	100	2 (Primary + Backup)	0.8	6	8	60			
3	IP/MPLS equipment at Data Center with redundancy	NA	NA	15		60				
4	IP/MPLS equipment at circle office	NA	NA	10		100				
	Sub Total					170.4	88			
Connectivity of Data Center & Circle Offices (Through IP/MPLS Link)						Year 1 (60 locations)		Year 2 (150 locatio		
5	IP/MPLS Leased Links from Aggregator site node to Circle office (Aggregator site is node which further connects 15 location)	50	1	0.5	3.2	2	12.8	5	32	
6	Optical connectivity for locations (Division/sub-Divison/ Section offices) (Average 4km O/H OFC for each location from node @ 2 L/Km)	4	1	8	0.8	480	48	1200	120	
8	IP/MPLS equipment at Aggregator site			6		24		60		
7	L3 Switch/Router at Locations (Division/sub-Divison/ Section offices)			3		180		450		
9	Misc./ Sevice items per Location			0.5		30		75		
	Sub Total					716.00	60.80	1790.00	152.00	
Total Cost for One year						886.4	148.8	1790.0	152.0	
Contigency (18%)						159.6	26.8	322.2	27.4	
Grand Total						1046.0	175.6	2112.2	179.4	

The details of the project are given in **Chapter 5 DPR for Augmentation of Communication Network in TPCODL Area**

1.4 Capital Expenditure in schemes other than DPR Schemes

TPCODL in addition to the above schemes which involve phasing of expenditure over a period greater than one year, has planned for capital expenditure which can be planned and would be also be completed in the same year i.e FY 2021-22. The Schemes include investment in Safety equipment, creation and refurbishment of Meter Testing facilities, Meter Replacement (Other than by Smart meters), Replacement of old and sick 33 KV/11 KV Equipment, augmentation of Distribution Transformers, setting up of infrastructure like call centres, investment in Information Technology , stores , offices and other administrative capex.

The details of the project are given in **Chapter 6 Description of Capital Expenditure Schemes other than DPR Schemes**

1.5 Unplanned Capex

TPCODL is an entity which has commenced operation on 1st June 2020 and since then has been planning its activities to meet the overall objectives stated in this submission. Such pursuit involves envisaging schemes that have a implementation period of about 3-4 years ("Schemes with a Road Map") and for also schemes which can be completed within a period of one year. However despite such planning, it is submitted that being a relatively new company with limited experience of operations, in particular with regards to Network improvement/development /modification etc, there are areas and instances where TPCODL is required to undertake capex which is not envisaged earlier or planned. Such capex may be termed as "Unplanned Capex". Following are some of the instances where there is a need for Unplanned Capex

1.5.1 Replacement of Transformers

We have encountered a situation where there was need for procurement of 12.5 MVA Transformer on account of impending overloading and non-availability of any spare transformer in the inventory. Further in case of transformer failure, procurement of new transformer having a lead time of 6 to 8 months. In approved capex FY 20 - 21, we have not provisioned for procurement of any new Power transformer and therefore in case of failure of any power transformer, it would become difficult to meet the affected load. One line of action would be to increase the inventory of transformers but this would not be optimum as it is quite difficult to predict and project the quantum of transformers in the inventory that is required. Moreover, Transformer is a costly item and it is not advisable to keep it in the inventory.

1.5.2 Enhancement of 33 KV feeder

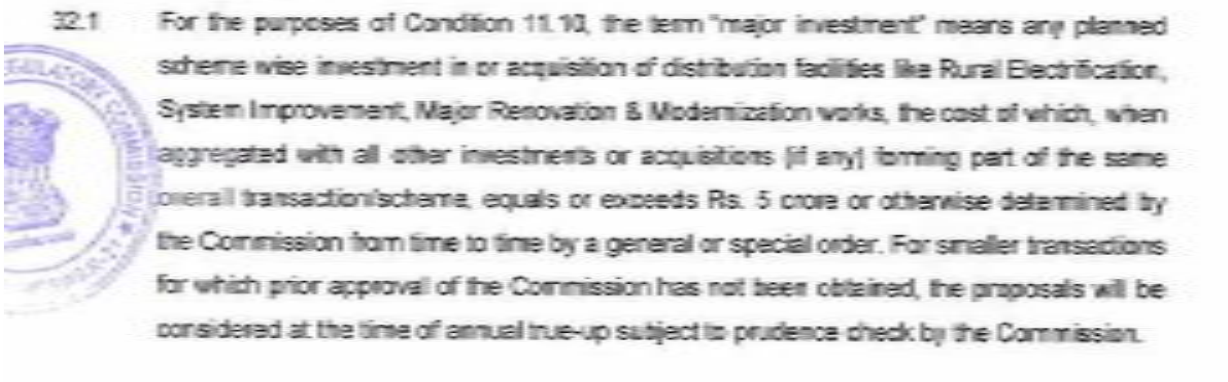
TPCODL had submitted a capital expenditure proposal in July 2020. However after the approval of the capex in September 2020, it came to light that certain lines could not be included in the original plan and could be planned only after studying the operational constraints further. One particular case is that a circuit is required to be laid from Bangurigaon to New Kakatpur 33KV feeder of length 11Ckt Km to bring reliability in the network. The estimate of the Capital Expenditure was Rs 4 Crores and we wish to execute this feeder before summer of 2021. But since this was not part of the approved Capex, therefore before proceeding for execution, it required Hon’ble commission’s approval. Similar requirement stands true for any new 220/33KV or 132/33KV OPTCL Grid substations for which new feeders are required to be laid for power evacuation from the newly commissioned OPTCL Grid.

1.5.3 Sick / defective Equipment in the system

We have deployed two teams for carrying out the detailed technical audit of 33/11KV Structures which covers the testing of all equipment to capture the healthiness of the system and further identify for major refurbishment and replacement. This will help us to improve the reliability of the power supply of the sub transmission system along with identification of the equipment which require immediate attention either through capital investment or through overhauling or preventive maintenance. Similar exercise is being done for 11KV feeders and Distribution Substations. Since the outcome of such audits cannot be envisaged now and so the fund requirement, therefore this can be planned and executed based on the criticality and requirement.

1.5.4 License conditions of TPCODL

The Hon'ble Commission has issued the License Condition for TPCODL on 24th August 2020. Under the conditions, the following is stipulated


32.1 For the purposes of Condition 11.10, the term "major investment" means any planned scheme wise investment in or acquisition of distribution facilities like Rural Electrification, System Improvement, Major Renovation & Modernization works, the cost of which, when aggregated with all other investments or acquisitions (if any) forming part of the same overall transaction/scheme, equals or exceeds Rs. 5 crore or otherwise determined by the Commission from time to time by a general or special order. For smaller transactions for which prior approval of the Commission has not been obtained, the proposals will be considered at the time of annual true-up subject to prudence check by the Commission.

11.8 The Licensee shall not undertake schemes involving Major Investments, not covered under the Investment Plan approved by the Commission under Condition 11.3 above without the prior approval of the Commission, and for such approval the Licensee shall demonstrate to the satisfaction of the Commission the factors mentioned in Condition 11.3 above.

..

11.10 For the purposes of this Condition 11, the term "Major Investment" means any planned investment in or acquisition of Distribution facilities, the cost of which, when aggregated with all other investments or acquisitions (if any) forming part of the same overall transaction, equals or exceeds an amount contained in the Specific Conditions applicable to the Licensee or otherwise decided by the Commission from time to time by a general or specific order (Refer Condition no. 32.1).

11.11 The Licensee shall be entitled to make Investment in the Distribution Business other than those covered under Conditions 11.3 and 11.8 above but for the purposes of considering such Investment while determining the tariff, the Licensee shall satisfy the Commission that the Investment was required for the Distribution Business and such investment was made in an efficient, co-ordinated and economical manner.

While the License Conditions permit undertaking Major Investment to the extent of Rs 5 Crores without the prior approval fo the Hon'ble Commission, we request the Hon'ble Commission to clarify the interpretation of the same. Our reading of the License Condition 32.1 suggest that overall investment of Rs 5 Crore is permitted in an year for incurring capex without the prior approval of the Hon'ble Commission. In our humble submission, such quantum of Rs 5 Crore is quite insufficient atleast in the initial period of operation for TPCODL.

Further the License condition permits the Hon'ble Commission to revise such limit of Rs 5 Crores through a general or special order. Moreover such clause of 32.1 is related to capital expenditure for which no prior approval is necessary. However we are through this petition seeking approval for unplanned capex for the FY 2021-22.

1.5.5 Request to the Hon'ble Commission

Based on the study of Operations so far and also the condition of the present network, we request the Hon'ble Commission to kindly approve an unplanned capital expenditure of Rs 20 Crores for FY 2021-22 towards network activities. Such capital expenditure may be trued up based on the prudency check by the Hon’ble Commission

1.6 Employee Costs to be capitalised

It is submitted that Employee Cost associated with the projects or capex schemes would also form a part of the Capex and would be eventually capitalized with the capital expenditure scheme. At present due to being in Initial stage, the manpower of TPCODL and various departments have not been segregated into those required for Capex and those required for operations and services of the business. Hence it is very difficult to identify the employees and their costs to be included for capitalization. In absence of the same, we have relied on the findings of the order dated 26th April 2011 in Case No 63 of 2006 and Case No 03 of 2007 of the Hon'ble Commission in which it was held that supervision charges payable to the extent of 6% on the total applied the same to work out the employee cost associated with the Capital Expenditure. However, the actual Employee cost that would be required to be capitalised would be determined on the basis of the organization structure that would be finalised for working out such employee costs.

1.7 Interest During Construction

The Interest During Construction (IDC) is worked out on the Debt Component (70%) of the Capex and is shown in the table below

Table 1-11 :Interest During Construction (IDC)

		Year
Sr No	**Particulars**	**FY 2021-22**
1	Opening CWIP	0.00
2	Capex	567.98
3	Capitalisation	374.69
4	Closing CWIP	193.29
5	Average CWIP	96.64
	Loan Movement	
6	Opening Balance	0.00
7= 70% of (2)	Addition	397.58
8= 70 % of (3)	Capitalisation	262.28
9	Closing Balance	135.30
	IDC Working movement (on Loan OB and Addition)	
10	Opening Balance	0.00
11*	IDC for the Year= RoI x (OB+Net Addtion/2)	5.40
12= (10 +11)x(8/(6+7))	IDC Capitalised	3.56
13	Closing Balance	1.84

* ROI of 7.98%. Net Capex= Capex less Capitalisation

1.8 Summary of the Capex and Capitalisation in FY 2021-22 (i.e other than Carry forward Schemes)

Table 1-12 :Summary of Capex and Capitalisation

Sr No	Head of Expenditure	Capex	Capitalisation
1	Statutory & Safety	27.3	18.5
2	Loss Reduction	191.5	134.1
3	Reliability	160.7	83.4
4	Load Growth	58.7	56.0
5	Infrastructure	109.7	62.8
6	Unplanned Capex	20.0	20.0
	Total Hard Costs	**568.0**	**374.7**
7	Employee Costs	34.1	22.48
8	IDC	5.4	3.56
	Total Costs	**607.5**	**400.7**

1.9 Carry forward of capital expenditure in FY 2020-21

The Hon'ble Commission had approved a Capital Expenditure of **Rs 281 Crores** to be incurred for FY 2020-21 in the orde of Case No 32 of 2020 on 8th September 2020. Thereafter TPCODL has accelerated its Capital Expenditure programme, simultaneously with the order placement in SAP. The progress under various heads is as given in the following Tables. It is submitted TPCODL has placed orders worth Rs 194.52 Crores have been placed by TPCODL so far.

The summary of the position of the Capital Expenditure as on 20th January 2021 with regards to the Orders placed demonstrating the commitment towards the same and comparison of the this with the Capital Investment approved by the Hon'ble Commission in the order dated 8th September 2020 is as given in the Table below:

Table 1-13: Summary of Capital Expenditure approved for FY 2020-21 (Rs Cr)

Capex Head	PO/RO Released (Commitment)	OERC Approved
Infrastructure	45.43	91.35
Load Growth	0.18	9.00
Loss Reduction	73.68	39.63*
Reliability	37.95	72.48
Statutory & Safety	37.28	68.17
Deposit Work		
	194.52	**241.00**

* part of the Metering Expenditure was directed to be recovered through meter rents

The breakup of the same under various schemes is as presented in the table below

Table 1-14: Breakup of the Orders Placed in FY 2020-21 (Rs Cr)

Budget Header	Budget Sub Category	Budget Activity	
Infrastructure	Admin	Ready to use assets for offices	1.00
	Call Centre	Infrastructure for Customer Care , Call Center , Payment Center and Section Offices	0.05
	Civil	Civil Upgradation	9.30
	GIS	Implementation of GIS 1st phase	0.19
	Information Technology	ERP, MBC, CIS and BI Systems S/w & H/w	27.97
		User End Devices Laptop,Desktop,Printers	6.37
	Stores	Security system in Central Store	0.55
Infrastructure Total			45.43
Load Growth	Addition / Augmentation	Network augmentation / addition to meet	0.18
Load Growth Total			0.18
Loss Reduction	11 KV Feeder	Optimizing the length of 11KV Feeders	7.20
	Defective Meter Replacement	Meter replacement against Burnt/Faulty a	61.49
			4.16
	Meter Reading	Solution for meter reading and spot bill	0.83
Loss Reduction Total			73.68
Reliability	Network Reliability	110 Nos. GSS refurbishment for SCADA	11.35
		Installation of 11 KV AB switches for im	4.89
		Installation of 33 KV AB switches for im	1.26
		Installation of Auto reclosure / Section	13.38
		Installation of LV protection at DSS	5.03
		Replacement of Battery and Battery charg	2.03
Reliability Total			37.95
Statutory & Safety	Statutory & Safety	33KV Network refurbishment to ensure Hor	3.87
		DSS Refurbishment for safety of Employee	28.14
		PPEs, FFEs, Safety & Testing Equipment	5.27
Statutory & Safety Total			37.28
Total			**194.52**

It is further submitted that actual position of the Capex may be measured not just by the commitment made as captured above but through the Goods Receipt Notes (GRNs) and Service Entry Sheets for the services availed and the same is capture in the Table Below

Table 1-15: GRNs and Service Entry Sheets for the Capex (Rs Cr)

Budget Header	Budget Sub Category	Budget Activity	Rs Cr
Infrastructure	Admin	Ready to use assets for offices	0.97
	Call Centre	Infrastructure for Customer Care , Call Center , Payment Center and Section Offices	0.03
	Civil	Civil Upgradation	1.28
	Information Technology	ERP, MBC, CIS and BI Systems S/w & H/w	17.36
		User End Devices Laptop,Desktop,Printers	3.85
Infrastructure Total			23.49
Loss Reduction	11 KV Feeder	Optimizing the length of 11KV Feeders	-0.05
	Defective Meter Replace	Meter replacement against Burnt/Faulty a	30.18
	Meter Reading	Solution for meter reading and spot bill	0.83
Loss Reduction Total			30.95
Reliability	Network Reliability	110 Nos. GSS refurbishment for SCADA	0.29
		Replacement of Battery and Battery charg	0.05
Reliability Total			0.34
Statutory & Safety	Statutory & Safety	33KV Network refurbishment to ensure Hor	0.13
		DSS Refurbishment for safety of Employee	2.55
		PPEs, FFEs, Safety & Testing Equipment	3.45
Statutory & Safety Total			6.13
Grand Total			**60.90**

While the difference between the GRNs/Service Entry Sheets and the Orders placed is quite large, we wish to submit that such difference is account of the following

- A large number of items have a long lead time and would actually be received only after some time.
- Some invoices have still not been raised by BA's have not been captured

In our humble submission, we have made satisfactory progress keeping in mind that we have had only about 4 months so far after the order of the Hon'ble Commission and also that new systems are being implemented since the commencement on 1st June 2020.

1.9.1 Request to the Hon'ble Commission

In view of the above, while we are making all efforts to complete the schemes to the extent of the approved amount, we are apprehensive that our Capex quantum for FY 2020-21 would be lesser than the amount as approved by the Hon'ble Commission. We therefore request the Hon'ble Commission to kindly permit carryforward of the expenditure not incurred but approved for FY 2020-21 to FY 2021-22

1.10 Comparison with Capital Expenditure envisaged under Vesting Order

The vesting order dated 26th May 2020 had stipulated minimum

42. Capital investment plan

(a) The RFP required the bidders to provide a capital expenditure plan for first 5 years of license operations as part of their bid. The minimum cumulative capital expenditure commitment sought from bidders was Rs. 500 crores(Indian Rupee Five hundred crore only) for the first 5 years of operations.

(b) In its Bid submitted in response to the RFP, TPCL committed capital expenditure of Rs. 1,541 crores(Indian Rupee One thousand five hundred and forty-one crore only) for period FY 2021 to FY 2025 as follows:

Table 1: TPCL Capital Expenditure Commitment

FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	Total
201	393	310	338	299	1,541

(Values in Rs. crore)

(c) To allow flexibility in the capital expenditure planning, the Commission stipulates that, in the capital expenditure plan to be submitted by TPCODLas per the license conditions, the capital expenditure commitment for each year of the period FY 2021 to FY 2025 must be such that capital expenditure proposed upto a year shall be at least equal to the cumulative capital expenditure committed upto that year in the Bid submitted by TPCL. For avoidance of doubt, the minimum cumulative capital expenditure to be proposed by TPCODLfor the period FY 2021 to FY 2025 must be as provided in the table below:

Table 2 : TPCL Cumulative Capital Expenditure for 5 years

Upto 31-Mar-2021	Upto 31-Mar-2022	Upto 31-Mar-2023	Upto 31-Mar-2024	Upto 31-Mar-2025
201	594	904	1,242	1,541

(Values in Rs. crore)

(d) In view of COVID-19 crisis, the Commission notes that TPCODL might face challenges in meeting the capital expenditure commitment for year 1 i.e. FY 21. The Commission therefore relaxes the minimum capital expenditure requirement for year 1 i.e. for FY 21. TPCODL shall be allowed to roll over the capital expenditure planned for FY 21 to the year FY 22. By the end of FY 22, TPCODL shall be required to meet the cumulative capital expenditure of Rs. 594 crores(Indian Rupee Five hundred and ninety-four crore only) as per its commitment.

As can be seen from the above extracts, the Vesting Order stipulates a minimum Capital Expenditure of Rs 594 Crores upto 31st March 2022. As compared to the same, based on the submissions and projections in this petition, the expected performance of TPCODL till the end of FY 2021-22 is as follows:

Table 1-16: Capital Expenditure from 1st June 2020 to 31st March 2022

Rs Cr

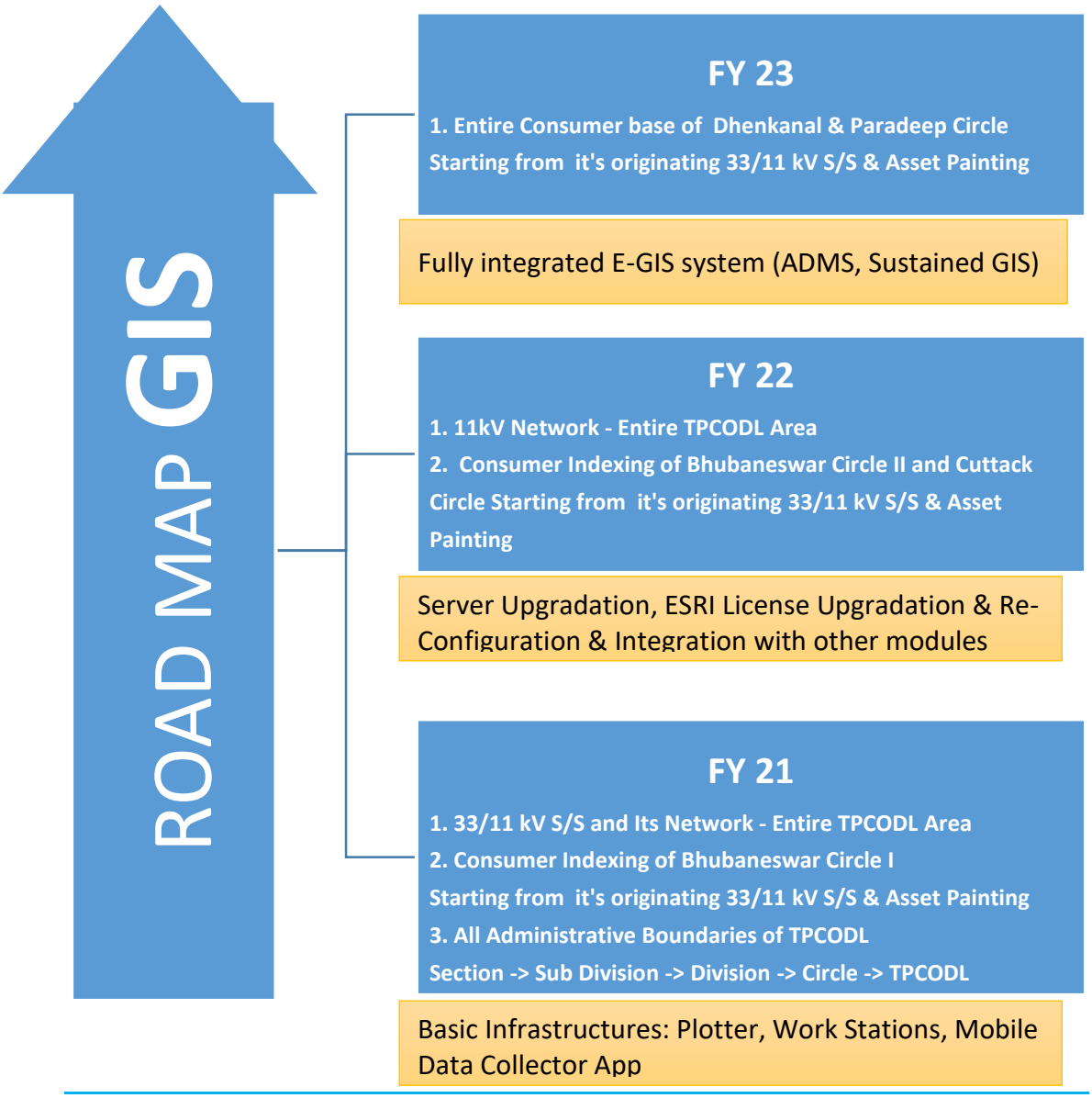
Sr No	Particulars	FY 2020-21	FY 2021-22	Total
1	Capex Approved (Hard Cost)	281		848.9759
2	Capex Proposed in this petition (Hard Costs)		568.0	
3	Employee Costs	16.86	34.1	50.94
4	IDC	5.06	5.40	10.45
5	**Total**	**303**	**607.5**	**910.37**

1.11 Prayers to the Hon'ble Commission

TPCODL prays the following to the Hon'ble Commission

i. Approve the Capital Expenditure plan and breakup as proposed in **Table 1-12 :Summary of Capex and Capitalisation** for the FY 2021-22 on account this capital expenditure
ii. Approve the carry forward of the capital expenditure of the schemes approved in the FY 2020-21
iii. Approve the manner of computation of IDC and Employee cost proposed
iv. Any other direction as the Hon'ble Commission may think appropriate

2 DPR for Implementation of Geographic Information System (GIS)



2.1 Background

TP Central Odisha Distribution Limited (TPCODL) is incorporated as 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. TPCODL took over the license of distribute electricity in the central part of Odisha, which was earlier served by erstwhile CESU. TPCODL's utility business is governed by the provisions of license issued by Hon'ble OERC for distribution and retail supply of electricity in Central Odisha.

TPCODL licensed area is spread over a geography of 29354 Sq. Km and serve the registered consumer base of 2.7 million with a peak load of around 1590 MVA. It receives electrical power at a sub transmission voltage of 33 kV from Odisha Power Transmission Company Limited's (OPTCL) 220 / 132 / 33 kV Grid Substations and then distributes the power at 33 kV / 11 kV / 440 V / 230 V depending on the demand of the consumers. For effective operations, the license area is divided into 5 circles which is further sub divided into 20 Divisions and 64 Sub-divisions which manage the commercial and O&M activities in order to serve its consumers.

2.2 TPCODL Vision

Tata Power has always been an early implementer of latest technology in India and has perhaps most number of standalone and integrated technology platforms in use. These technologies have been instrumental in improving the overall performance of the company and also been able to deliver business benefit in terms of lowering losses and improving reliability. Tata Power's competence in adaptation of latest technology makes it very appropriate to take initiative to lead conceptualization and implementation of state of the art automation technologies in TPCODL.

TPCODL has always the quest for adapting new technologies to provide quality customer services, manage revenue cycle processes for reduction of AT&C losses and efficiently manage to deliver highly reliable and improved quality supply in safe manner to its consumers by meeting various standards of operation.

In line with adoption of technology, TPCODL implemented under RAPDRP the Geospatial technology (GIS System) to simplify records management for the key assets of the organization, thus leading to a decrease in operational costs. Linking the customer and asset data to a

geographic location on a map allows the operation team to look at the bigger picture and thus makes for a powerful decision-making tool.

GIS is an enterprise software application that maintains the locational and physical attributes of electric infrastructure overlaid on the geographic, political, property and other real-world features. The system is used lity as the source of infrastructure information. The system keeps track of electric delivery networks and all of the elements that comprise those networks.

For operating personnel, GIS is the essential source of information about assets— what and where they are and what is around them. Combined with customer information, GIS becomes an essential tool for providing customer service and planning the maintenance and expansion of infrastructure.

2.3 Benefits of GIS Applications

Table 2-1: Benefits of GIS Applications

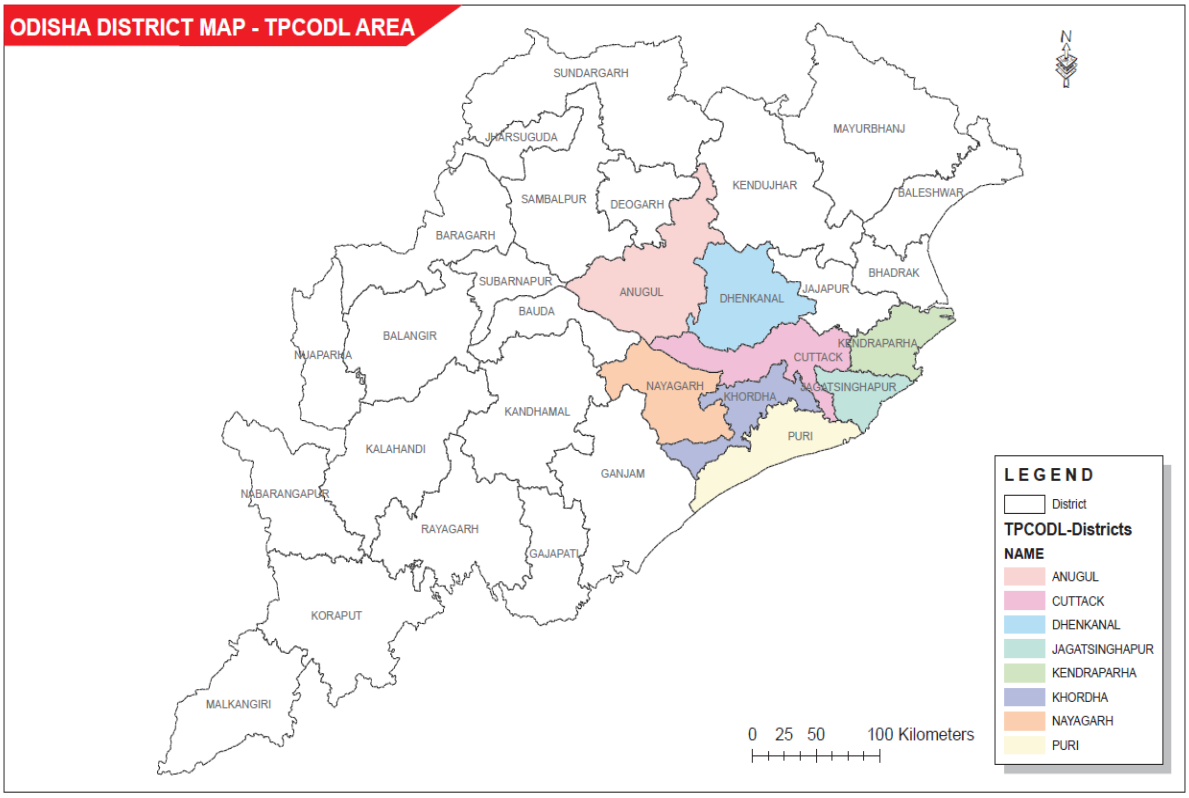
Sr. No	Features	Benefits
1	Master Repository of Asset & Network with its Topology	In present scenario, provision of keeping of assets /network details in single format in single data base for entire TPCODL is not in place. Each division is following their own practices for their operations at site based on their local knowledge of network. Once GIS is in place, Entire Asset base of TPCODL will be available in one single data base with its connectivity as per the ground reality in terms of Geometry and Diagram. At any point of time, location of any object / equipment mapped in GIS shall be available and traceable to its source Sub Station, MIS & Dashboards of Assets shall be available at each administrative level starting from Sections, Sub Divisions, and Divisions & Circle.

Sr. No	Features	Benefits
		This will facilitate faster restoration and optimise the Outage duration for increased availability, further better / prudent asset utilisation.
2	Provides accurate Network hierarchy for Energy Audit	Feeder –wise Energy Audit / DT-wise Energy Audit in SAP ISU based on the DT Code, Feeder Code from GIS against each Consumer / DT. Locate consumers having defective meters, not paying bills, zero consumption meters with major consumption variation for further analysis in conjunction with DT-wise reports. Analyse Energy Balance report for finding the root cause of variations. Provide list of consumers whose meter reading history shows major difference Display the location / area of customers, complaining about non-delivery / late delivery of bills for taking suitable corrective action Change in NOP (Normal Operating Point) of Network and associated DTs and its Consumers can be traced at any point of time for calculating the differential energy consumptions. **Service Level wise energy accounting with clear areas of attention for action in terms of loss reduction. It will also help in uniform distribution of load across the LT and HT network geographically.**
3	Consumer Indexing from Connected Pole/ FP to its Source S/S	Locate consumers on the map in case of activities like disconnection, reconnection, load enhancement / reductions. Call centre can become aware about the location of the affected Consumers, based on the tripping of any equipment, so that they can respond to the customer complaints from the affected area.

Sr. No	Features	Benefits
		Generate optimised walking sequence for meter reading and bill distribution based on the billing cycle and shows it on map. Provide list of consumers and locations whose meter reading history shows major difference. **The Geographic indexing will help maintenance team to pin point the location and equipment of fault resulting in to faster response time.**
4	Incremental updation of data for processes effectiveness	Tracking the status of the ongoing scheme / new connection (till the release of power supply) Creation of Assets at Division level and equipment movement with the help of SAP – Fixed Asset Inventory which is to be linked with the GIS asset IDs. New Consumers to be mapped in GIS system through process shall make the system robust. **Process based work flow of new connection starting from feasibility (Network Proximity and Load flow), estimation, project execution, commissioning and release of supply. This will help in reducing the cycle time for adding of new consumer.**
5	Enhance the efficiency in Distribution.	Carry out the preventive and breakdown maintenance activity, GIS locates the equipment and its supported network. Calculating reliability indices. Prepare the meter testing schedule using cluster analysis on GIS. Prepare the meter replacement schedule Route Planning - Optimum / shortest path among the selected customers. Locate the cheque drop boxes, electronic cheque drop boxes and a cash collection centres in proximity to customers' clusters

Sr. No	Features	Benefits
		Locate the nearest drop box, cash collection centre, electronic drop box from any consumer location **This would improve the billing and collection efficiency.**

Figure 2-1 : ODISHA District MAP – TPCODL AREA



2.3.1 GIS at Tata Power Delhi Distribution

The GIS group at Tata Power Delhi Distribution plays key role in critical processes of the organization, including but not limited to

Operations Management:
Provide single source data for network, asset and consumers for ADMS use cases.
Commercial Management:
Support Technical Feasibility of new connections by providing underlying Transformer to Pole to consumer connectivity data, Real-time analysis for electrification status of a new connection locality, Ensuring network data availability for Energy Auditing etc.

Finance & Asset Management:
Verification of assets utilized in schemes and clearance of schemes for capitalization.
Regulatory & Other compliances:
Developing Asset & network maps and Reports as required for Regulatory Audits and other purposes.

2.3.2 GIS at Tata Power Mumbai

Tata Power GIS is strategically supporting numerous distribution business processes from planning, designing to implementation of distribution projects, then supporting O&M functions. Moving forward Tata Power has successfully integrated GIS with other enterprise systems such as ERP, Network Planning System, Distribution Management System, Customer Relationship Management, Vehicle Tracking System (VTS) and mobility platform.

This GIS with its capacity of locational intelligence, SPATIAL analysis capabilities, and database querying, integrated landscapes are able to critically support numerous other functions of business. Currently GIS is supporting 25+ different functions of distribution such as consumer engineering, Project, marketing, meter & connection mgmt., Revenue Recovery, Vigilance, O&M, Regulation, Call Center, technical complaint management, Customer Relations and many more for their day-to-day activities with different business specific customized applications, analytical tools which are in-house developed on GIS platform from time to time. GIS has impacted directly or indirectly to @65% of Enterprise process management (EPM) processes of Tata Power Distribution and has become a backbone for distribution business overall.

2.3.3 Adoption of Technology

- GIS based automated "Feasibility utility" for initial estimate calculation for faster response to new customer connections. Use of GIS is enabling more realistic long term and short term planning for distribution network augmentation and growth.
- Use of GIS and SAP-PS integrated workflow platform for new distribution project designs leading to accurate estimation and proper expenditure and then monitoring the complete progress of the project, from planning to commissioning, on the GIS integrated platform.
- GIS is one of the main sources of information and for doing analysis for getting approvals from MERC for DPRs and responding to the queries with spatial analysis and GIS maps.
- The integration of GIS with other enterprise systems has augmented work flow management, automated updating of data, synchronization and tracking of equipment/asset information more effectively.

2.4 Area of Interest (TPCODL)

TP Central Odisha Distribution Limited (TPCODL) is a joint venture between Tata Power and the Government of Odisha with the majority stake being held by Tata Power Company (51%). TPCODL serves a population of 1.36 Crore with Customer Base of 27 Lakh and a vast Distribution Area of 29,354 Sq. Km

Figure 2-2 :TPCODL Distribution Boundary

Table 2-2 Division wise Consumer Base

Sr. No.	Division	Division Name	Customer (Nos)
1	AED	Atthagarh	122462
2	ANED	Angul	146406
3	BCDD-1	Bhubaneswar City - I	60347
4	BCDD-2	Bhubaneswar City - II	171724
5	BED	Bhubaneswar Elect	126054
6	BEDB	Balugaon	110684
7	CDD-I	Cuttack – I	75970
8	CDD-II	Cuttack – II	75015
9	CED	Cuttack Elect	152302
10	DED	Dhenkanal	183942
11	JED	Jagatsingh	121637
12	KED	Khurda	178643
13	KED-I	Kendrapara – I	193315
14	KED-II	Kendrapara – II	91110
15	NED	Nayagarh	205308
16	NEDN	Nimapara	178404
17	PDP	Paradeep	108497
18	PED	Puri	179970
19	SED	Salepur	112489
20	TED	Talcher	138811
			2733090

2.5 Present Implementation of GIS

Under R-APDRP scheme, 12 towns of Central Electricity Supply Utility of Odisha have been covered. Details of approved towns are as follows:

Table 2-3: Details of 12 Towns covered under RAPDRP Project

Sr. No.	Town Name	Connections	Area (Sq. Km)	No. of Sub Division Offices	No. of Other Offices	Total No. of Offices
1	Cuttack	90,252	64	7	17	24
2	Bhubaneswar (HQ)	2,21,595	135	8	38	46
3	Puri	37,496	17	3	16	19
4	Khordha	8,547	26	2	3	5
5	Jatni	7,138	25	1	3	4
6	Dhenkanal	14,878	31	1	8	9
7	Angul	13,669	19	1	5	6
8	Talcher	6,375	26	1	2	3
9	Kendrapara	9,008	11	2	3	5
10	Pattamundai	6,137	24	1	5	6
11	Jagatsinghpur	6,385	18	1	7	8
12	Paradeep	3,654	32	1	1	2
TPCODL Total		**4,25,134**	**428**	**29**	**108**	**137**

Figure 2-3 TPCODL Consumer Mapped in the current GIS System

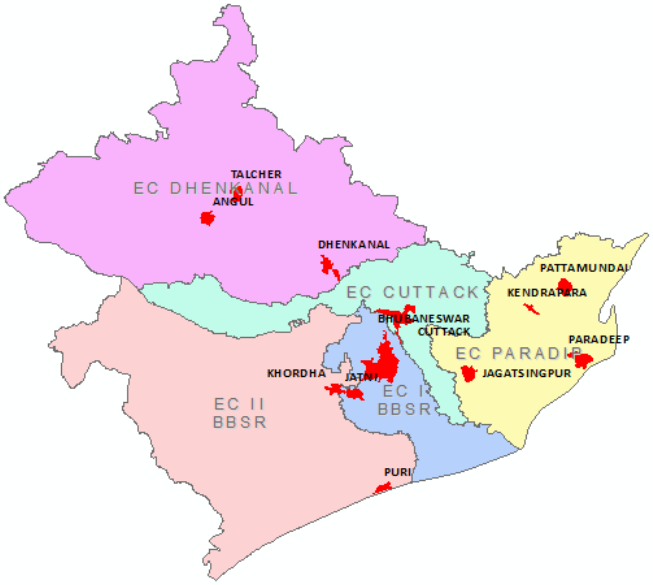


Table 2-4 GIS Surveyed Summary

GIS Surveyed summary / Count of total 12 towns	
Name	Count / Total
HT consumer count	4544
LT consumer count	434216
HT line – Crkt. Km	2433
LT line – Crkt. Km	3850
Substation	64
DTC	12811
Cross over point count	150
Feeder count (including 33&11kV)	500

Area: 428 Sq. Km**. 1.5%** of Total TPCODL Area **Consumer Mapped**: **16.9%**

Table 2-5 : Area of 12 Towns covered under RAPDRP Project

Sr. No.	Circle Name	Circle Area (Sq Km)	Town Name (RAPDRP)	Area Covered (Sq Km)	Area Covered of Circle (Sq km)	% Area Covered (RAPDRP)
1	CUTTACK	2754	Cuttack(CDD-1,CDD-2)	64	64	2.32
2	EC I - BHUBANESWAR	2183	Bhubaneswar (HQ) (BCDD-1,BCDD-2,BED)	135	135	6.19
3	EC II - BHUBANESWAR	9422	Puri	17	68	0.76
			Khordha	26		
			Jatni	25		
4	DHENKANAL	10565	Dhenkanal	31	76	0.84
			Angul	19		
			Talcher	26		
5	PARADEEP	4430	Kendrapara	11	85	2.79
			Pattamundai	24		
			Jagatsinghpur	18		
			Paradeep	32		
Total:-29354				**428**	**428**	**1.46**

2.5.1 Excluded scope under R-APDRP

- Software License AMC
- Data Sustenance of 12 Towns - 428 Sq. Km from year 2018
- Mobile Application for Capturing of Data
- Sustenance Process & Integration with Mobile Application
- 98% of TPCODL area (Rural, Part of Urban & Smaller Towns)
- Utility Specific Integration

2.6 TPCODL Approach

Existing GIS solution should be upgraded to ArcGIS Enterprise 10.6.1, ArcGIS desktop 10.6.1 and necessary Arc FM components. Since very few users update data through the Web, it is recommended that bulk data creation, editing and updating should be done through Desktop instead of Web. Some of the minor updating processes can be done through the web-based editing.

The web application should have the mapping of the user, role, and administrative boundaries to spatial & non-spatial data so that user of specific town can only view data within his admin boundaries.

The caching technique should be optimized w.r.t role and users admin boundaries for faster performance and rendering of maps.

Integration with different applications should be done to automate the different process, which will save time and effort of employees. Integration touch points can be detailed out as per users' requirements.

GIS Application should be integrated with other applications for accurate Energy Audit i.e.

1. Network Analysis
2. AMR (Automated Meter Reading)
3. MBC (Metering Billing and Collection)
4. SCADA (Supervisory Control and Data Acquisition System)

With GIS, Utility personnel can respond rapidly to service requests. Locate and resolve delivery problems quickly and efficiently; reduce the extent and duration of service interruptions and provide better customer service overall. Customers can access Utility GIS information through the Customer Web Portal to view real-time information about outages and service quality.

2.7 Benefits of Integration with other Modules

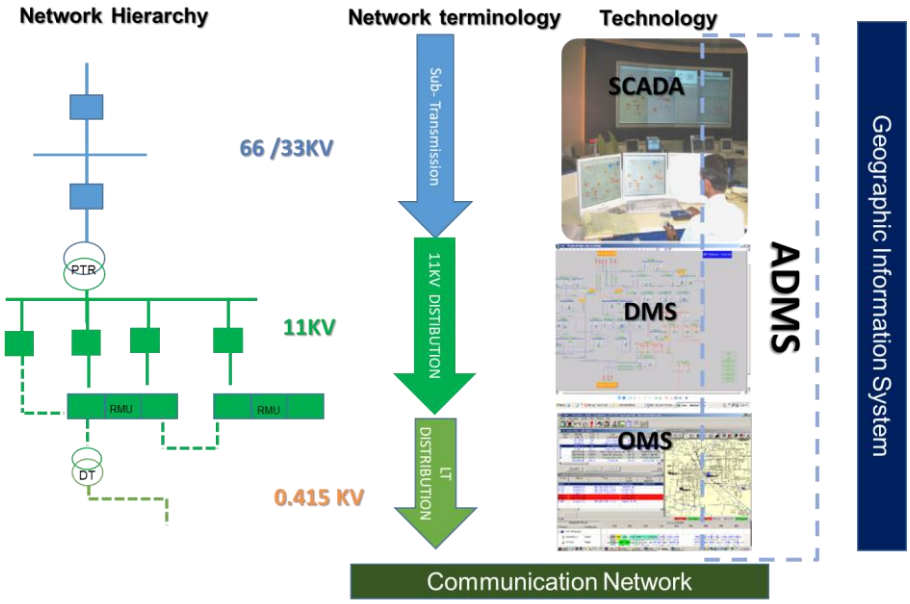
- Integration with Outage Management System (OMS), Advanced Distribution System (ADMS) for Operation Management
- Integration with Enterprise Resource Planning (ERP) for Consumer mapping & Energy Auditing
- Integration with Design Manager for Network Planning, execution and capitalization
- Interface with Website for Nearest Cash Collection Centres, Complaint Centre etc. for Consumer Services.
- Interface with Google Maps for visualization of field reality for faster data update.
- Integration with SCADA will reduce cost and time for network asset mapping in SCADA System which will improve overall efficiency of operation resulting reliability of power supply and customer satisfactions.

Figure 2-4 :Proposed Enterprise System Integration with GIS System

2.8 GIS - Foundation for a Smart Grid

GIS is the back bone of SCADA, DMS and OMS. It provides actual network connectivity and hierarchy at Sub Transmission, 11 kV Distribution and LT Distribution Level. The same is depicted in the figure below

Figure 2-5: GIS: Foundation for a Smart Grid



2.8.1 MIS / Report for Utility

GIS can provide multiple reports related to electric assets which will be useful for Utility such as.

Table 2-6 Indicative MIS Reports / Quality Checkers

MIS Reports	Description
33/11KV Station to Consumer report (All network levels)	33/11KV Station to Consumer report with Equipment, Substation and Structure information dumped into formatted text files
Area wise DT to Consumers Report (LV Network)	Area Wise Transformer to Consumer report based on trace – listing not traced consumers as well
LT Feeder Report	Creates a data dump of LT Lines and Cables based on LT Feeder name. Summary and Details shall get generated at the backend in tab-delimited text format
DT Report	Creates data of Transformers - It generates Division and sub Division wise count of the transformer, the report will cover the rating and type of transformer
RMU Report	Creates data of RMU - It generates Division and sub Division wise count of RMU, the report will also cover the rating and type of RMU
Pole Report	Creates data of Poles - It generates Division and sub Division wise count of Pole, the report will also cover Pole No./ and type of Pole
Report for GIS Objects Geographical Coordinates	Report for extracting GIS Objects Geographical Coordinates in ArcGIS
Application Login User Details Report	Login user details/history reports need to be created.
Feeder Pillar/pole & Service Pillar/line Report	Creates a data of Feeder Pillar & Service Pillar - It generates Division and sub Division wise count of Feeder Pillar & Service Pillar, the report will also cover the rating and type of Feeder Pillar & Service Pillar Report
LV Network Consistency Checker – Connectivity	A routine that traces all LT Lines and Cables upstream and checks the presence of a Transformer. In case a transformer is not found, the LT segments shall get reported
LV Network Consistency Checker – Network State	A routine that traces all LT Lines and Cables upstream and checks for consistency of Network State (In-service/Not In-service etc.).In of inconsistency, the LT segments shall get reported

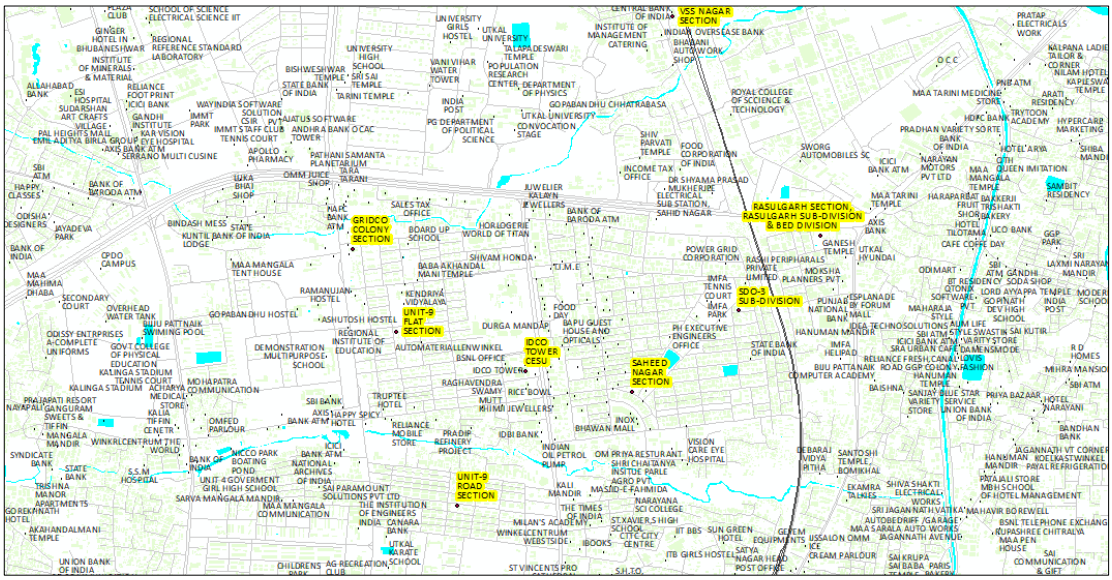
MIS Reports	Description
HV Network Consistency Checker – Connectivity	A routine that traces all HT Lines, HT Cables and Transformers upstream and checks the presence of a Grid Switching device. In case a Grid Switching device is not found, the HV elements shall get reported

2.9 Data Creation / Updation

There are three constituents of GIS system which constitute the complete system as given below

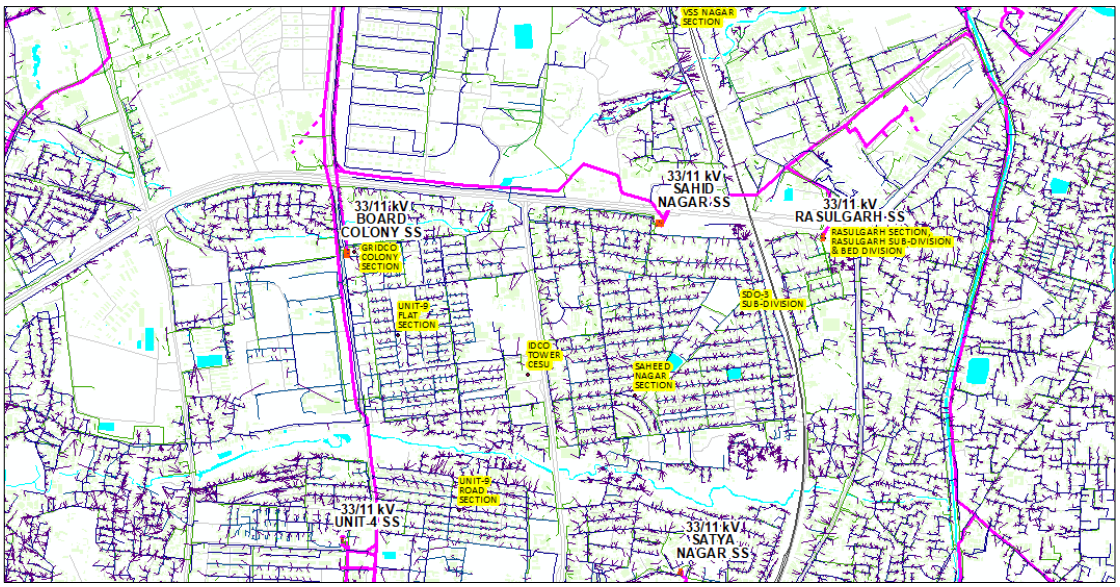
a. Base Map Creation

Figure 2-6 Base Map from Geo-Referenced Satellite Image and Important Landmarks



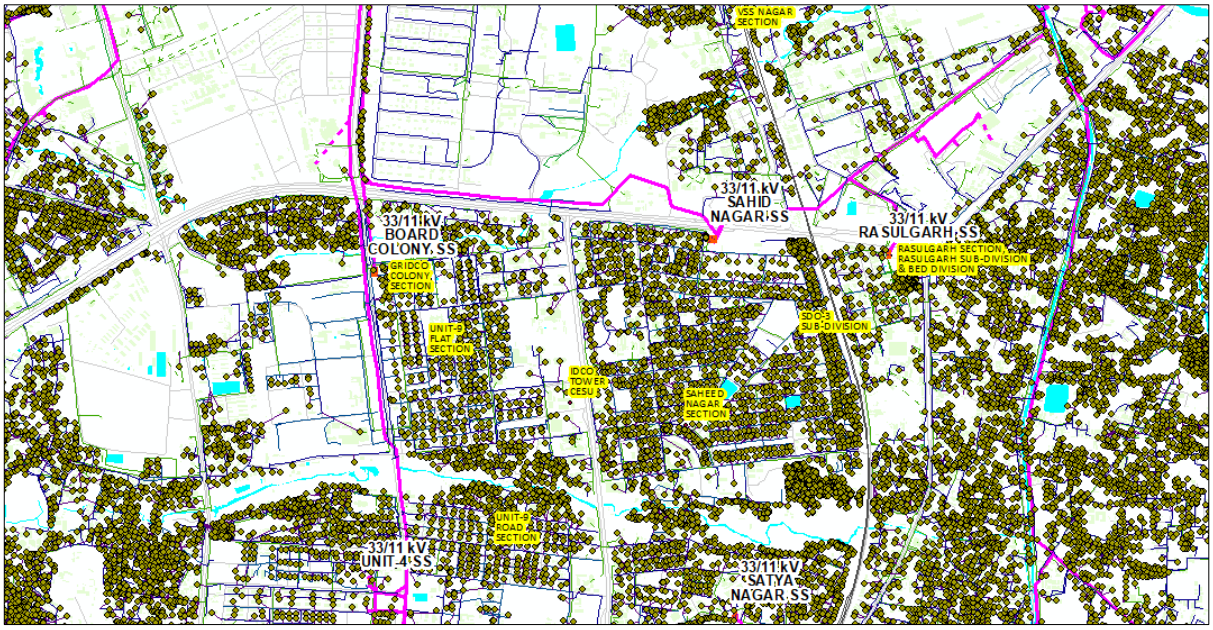
b. Utility Assets and its topology i.e. Electric equipment and network

Figure 2-7: **All Voltage Level Network Overlaid on Base Map**



c. Consumers Indexing

Figure 2-8 :Consumer Locations on Connected Network and Base Map



- Each constituent contain various objects and then various attributes for each object. By combining all objects and its attributes form a “Data Model” for GIS system. This document also elaborates on data model of GIS system.
- There are various applications and QA/QC tools which is being developed for ease of activities for users and generation of various reports for further analysis and action. These applications are being developed based on the data.

- There is integration of GIS with other system which provides the efficiency by improved processes and operation as well as effectiveness by various interlocks to avoid duplicity of data, enhanced accuracy and consolidated structure.

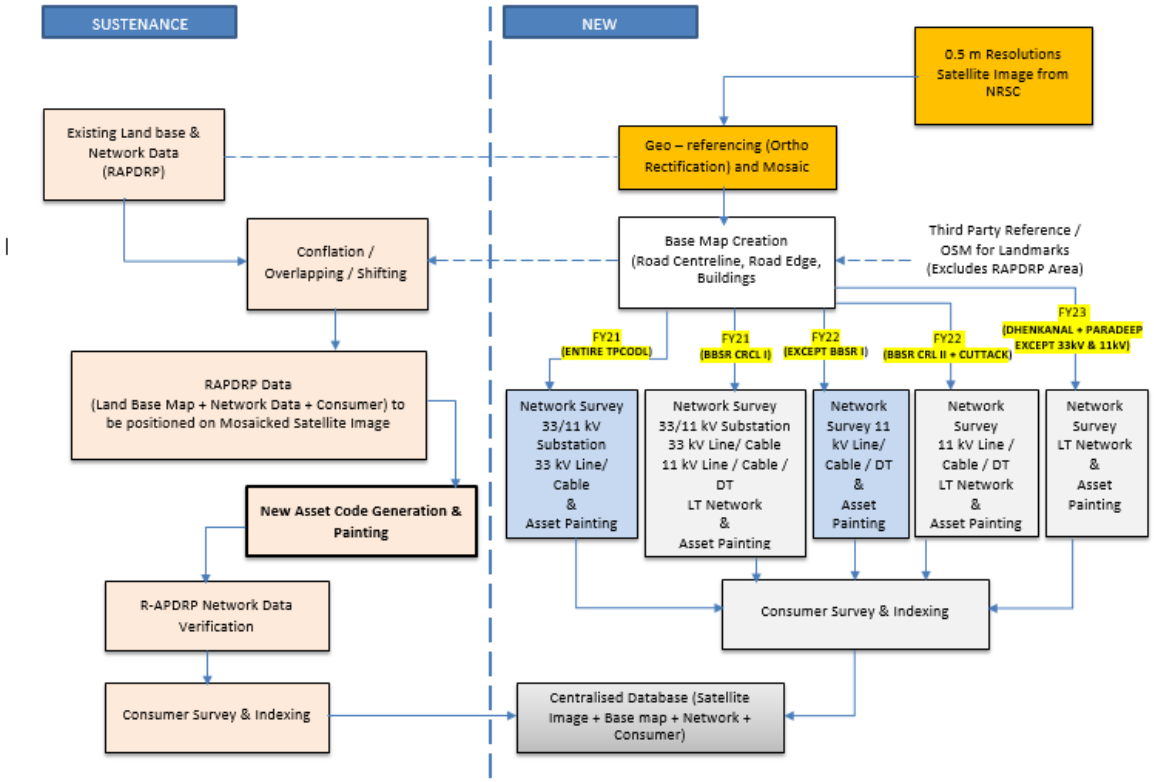
GIS based customer indexing and asset mapping can be effectively used for correct area wise mapping of utility assets, maintain the connectivity from the 33/11kV station to consumer etc. GIS mapping of Sub Transmission and Distribution network starts from 33 KV station up-to customer meter location along with other electrical assets. All the existing connections and consumer details shall be captured and displayed geographically in maps.

The purpose of GIS mapping and Indexing of the consumer is to identify and to locate all the consumers and other assets in the system. The complete electrical network and network route will be digitized and mapped in a suitable scale over base map using suitable GIS software, so that the changes in network can be timely and correctly updated on a periodic basis. With the help of proper consumer indexing and asset mapping, system can easily generate the Transformer wise feeder details and indexing i.e. the line coming out from the transformer along with its route , pole to pole connectivity and the details of the consumer connected to that specific line and pole/feeder pillar.

For customer indexing and asset mapping, Base map has to be created according to the AOI and all the pre-defined land base objects has to be captured along with its attributes. After base map creation, all the electrical network route and other pre-defined network objects starting from 33KV stations up-to consumer meter has to be captured along with their attribute details. The entire process of TPCODL Data capture from field is broadly divided into three field surveys:

1. **Network and Asset Survey** – Network starting of 33 kV feeder, 33/11kV substation to 11kV feeder route mapping, DTC & LT network route mapping including all support structure (Tower, Pole, and Feeder Pillar) will be captured through field survey.
2. **Consumer Survey & Mapping** - Details of consumer Location, Address, Phone Number & Meter installation having Meter Serial Number and Consumer Number will be captured by custom mobile application.
3. **Consumer Indexing** – Meter Device location and its connectivity from pole and network will be capture through field survey and will be tagged with Consumer / meter device location.

Figure 2-9: Data Creation / Updation Flow Chart



Technical Specification

- Data will be captured in 1:1000 Scales.
- The data shall be delivered in WGS84 datum with Geographic coordinates and UTM Zone 43N projection system.
- Objects defined in the data model shall be digitized from the satellite image and gaps should be verified and updated from the ground during field survey.

Inputs Required

- Satellite image (Geo Eye/ Digital Globe) – less than 50cm
- Development City Plans
- Layout Plans

Geo-referencing of Satellite Image / Registration of Maps

- Satellite Image / Digital raster maps and spatial data will be registered in the right geographical location using suitable registration techniques. The registration will be done precisely and accurately. Appropriate control points using **DGPS** survey or as available will be selected to register the raster maps. The registration information will be saved in the GIS database, so that the registered images can be retrieved to the correct geographical location.

Data Model (Land Base)

Anything which can be interpreted from satellite image will be captured. Layers to be captured in Land Base are as follows:

- Building
- Built-up
- Green
- Landmark
- Obstacles
- Rails
- Road
- Road Centre line
- Telecom
- Tree
- Utility Points
- Transit Area
- Water Area
- Flood Map
- Cluster of trees
- Traffic Signals
- Sub Locality
- Locality Boundary
- Pin code
- Right of Way
- City
- Satellite Image
- Development Plan Sheet
- Ward Boundaries

Digitization

Geo-referenced satellite image/ registered maps will be subdivided based on its area and shall be distributed among team members to carry out digitization in AutoCAD Map based on the data model and subsequent layers identified.

Data Entry QC & Corrections

Quality Control (QC) is necessary to eliminate the digitization / data entry errors. During this process, all entries will be checked to ensure quality output. The errors will be marked and send to production for corrections.

Validation / Topology

- Ensure that the all features are captured without missing
- Ensure that the Buildings are captured in proper shape
- Ensure that the Buildings are captured in proper orientation
- Ensure that the Buildings captured are complete in nature (if cluster of trees cover certain building then the operator should able to interpret and imagine the building shape if it is nearly 70% visible.
- Ensure that all the Built up have road connectivity
- Ensure that there are no Hanging roads
- Every feature has to be captured accurately under the layers
- There should not be more than one point feature in a single location
- Ensure that the linear features do not contain any snap errors
- Ensure that the Data do not contain any Zero Length Features
- Ensure that the Data do not contain any duplicate vertices
- Ensure that the Data do not contain any Undershoots/Overshoots
- Ensure that the Data do not contain any Pseudo Nodes
- Ensure that the Polygon features do not contain any sliver Polygons
- Ensure that the Polygon features do not contain any Zero Area Features
- Ensure that the Polygon features do not contain any duplicate vertices.
- Ensure that the Coinciding Polygons features to contain identical vertices.
- In all means, the data should be topologically clean

Data Collation and unique id creation

Information collected from other sources will be collated and will be entered. During data entry, a unique ID will be auto generated for each feature in the database and the same unique ID will be assigned to corresponding graphic feature digitized/converted.

Maps for Survey

A map book on 1:1000 scales will be prepared to carry out survey on the field. On the map all digitized features will be shown with its unique ids on it.

Survey Sheet

A tabular survey sheet along with map page will be prepared to collect the attributes as per the data model.

Survey Data Integration

Survey data will be merged with the digitized spatial data to create Land base of the area.

Data Model (Electrical Network)

A network data model will be defined based on the current business logic and rules before survey in field
Objects which needs to be captured under network mostly as
Structures

- Distribution Transformer
- Feeder Pillar
- RMU
- Pole
- Street Light Pole
- Tower

Conductors

- EHVHT Line
- EHVHT Cable
- Jumper
- LT Line
- LT Cable
- Service Line
- Devices
- Shunt Capacitor
- Shunt Reactor
- Supply Point
- Fuse
- Street Light Switch

Substation

- Circuit Breaker
- Relay
- Control and Relay Panel
- Lightning Arrester
- Busbar
- Current Transformer
- Grid Station
- Isolator
- Meter
- Panel Board

- Potential Transformer
- Power Transformer
- Battery Bank
- Battery Charger
- Substation
- Consumers

Network Objects

- Cut Point
- HT Joint
- MCB Box
- LT Joint
- Underground
- Cable Loop
- Conduit
- Duct

Other Objects

- Drop Box
- Map Grid
- Other Utilities
- Real Estate Building

Rule base Digitization

Manifolds and rules for digitization for electrical network will be prepared to capture the surveyed data on top of base map.

Pole Numbering and Asset Painting

In existing GIS system under RAPDRP Part A implemented by L&T for CESU/TPCODL, pole number has been assigned based on current electric connectivity, which is prone to change very often. So each time when network connectivity will change, the pole no of that feeder will change and repainting of pole no is required at field, which is a very tedious and expensive task.

So to avoid these circumstances each pole will be assigned a unique number based on their geographical location while considering Division, Sub division Boundary, Voltage level and Main roads.

2.10 Activities to be performed

- **Hardware, Software & Applications**

Table 2-7:Hardware / Software to be procured

Sl. No	Components	Material / Activity	Year of Execution
1	Procurement of Hardware	High End Work Station	FY 21
		Plotter	FY 21
2	Procurement of Software and Applications	Mobile Application	FY 21
		Auto CAD Map	FY 21
		Software Upgradation and Integration with other modules (BOQ as defined under RAPDRP Project and incremental Licenses)	FY 22
3	Training for the Employees	Training through third party agencies / OEM	FY 21

(1) Hardware

For Survey Data QC and porting to GIS System, 5 Nos of high end PCs / workstations are required to distribute the work area as the GIS data base will be very huge to handle. While updation WFS services to be taken as back drop and for that a very good system performance is required.

(2) Plotter / Printer

A typical GIS infrastructure requires lot of map hard copies and different groups like network planning & operational team at site requires maps to refer the network at the field. Even SLDs at each S/S and Division level to be printed periodically.

(3) Mobile Application

An Android and iOS based Mobile App for collection of GIS data is required to expedite the data collection process from field and at the same time O&M team shall use the application the keep the GIS data updated by intimating Centralised GIS team through redline process of Mobile Application.Some of the features would be

1. Geo fencing option to be available for defining the area of operation of Surveyors.
2. Surveyor may correct system offered position based on satellite imagery/land base within 10 meter before taking the point if required.

3. Surveyor may capture points both in offline and online mode. For offline survey data has to be uploaded at the end of day.
4. All attributes are to be available from available Billing data in predefined drop-down list for easy operation.
5. Geo tagging of Meter Device / Premise / Network objects to be made available.
6. 300 + Concurrent Users shall use the application

(4) Auto CAD Map

Auto CAD Map is a drafting & GIS application where all the SLDs will be digitised and make it GIS / DMS compatible by keeping GIS ids in each object. Data will be in synchronisation with GIS system and same data can be used for DMS purposes.

- **Data Creation & Managed Services**

Table 2-8: Data Creation and Data Porting Services

Sl. No	Activity	Quantity	Year of Execution
1	Satellite Image Procurement	30000 Sq. Km	FY 21
2	Base Map Creation	30000 Sq. Km	FY 21
3	Data Integration and Data Porting Managed Services	30000 Sq. Km	FY 21,22,23
4.a	BBSR Circle I 33 KV, 11, KV, LT Network Survey Asset Painting Consumer Indexing	Annexure 1,2,3 - Asset [1]Details	FY 21
4.b	Conflation of RADRP Towns on Base Map Verification of Network Data Change of Asset Number & Painting	Annexure 5 - RAPDRP Details	FY 21

[1] **Please refer to Chapter 7 Annexures A :**

Sl. No	Activity	Quantity	Year of Execution
5	33 / 11 KV S/S 33 KV Network Survey Direct Connected Consumer Indexing Asset Painting (Except BBSR Circle I + RAPDRP Towns)	Annexure 1 - Asset Details	FY 21
6	Consumer Mapping - BBSR Circle I	Annexure 4 - Consumer Count	FY 21
7	Consumer Mapping - BBSR II & Cuttack	Annexure 4 - Consumer Count	FY 22
8	Consumer Mapping - Paradeep & Dhenkanal	Annexure 4 - Consumer Count	FY 23
9	11 KV Network Survey Direct Connected Consumer Indexing Asset Painting (Except BBSR Circle I, BBSR Circle II and Cuttack + RAPDRP Towns)	Annexure 2 - Asset Details	FY 22
10.a	BBSR Circle II & Cuttack 11, KV, LT Network Survey Asset Painting Consumer Indexing	Annexure 1,2,3 - Asset Details	FY 22
10.b	Conflation of RADRP Towns on Base Map Verification of Network Data Change of Asset Number & Painting	Annexure 5 - RAPDRP Details	FY 22
11.a	Dhenkanal & Paradeep LT Network Survey Asset Painting Consumer Indexing	Annexure 1,2,3 - Asset Details	FY 23
11.b	Conflation of RADRP Towns on Base Map Verification of Network Data Change of Asset Number & Painting	Annexure 5 - RAPDRP Details	FY 23

- **Qualified Engineers**

To execute GIS data creation, porting, digitisation and for day to day updation in GIS system, additional 8 no's of qualified engineers are required on continual basis. Presently we have only 4 qualified engineers. During execution and sustenance we need 12 Numbers of Qualified engineers and 12 Number of Surveyors on Continual basis. Survey team shall be outsourced.

2.11 Phasing of Expenditure

- **Expenditure Plan (FY 21)**

Table 2-9 CAPEX FY 21

Sl.No	Components	Material / Activity	Bhubaneswar Circle I (100 % - Landbase, 33 kV, 11kV , LT & Consumer Indexing) + 33/11 kV SS annd 33 kV Network covering entire TPCODL area		
			QTY / Users	Unit Cost	Amount
1	Hardware	High End Work Station	5	2,00,000	10,00,000
		Plotter	1	10,00,000	10,00,000
2	Software and Applications	Mobile Application	300	Lump sum	20,00,000
		Software Upgradation and Integration with other modules (BOQ as defined under RAPDRP Project and incremental Licenses)	0	0	0
Total Material Cost (O)					40,00,000
3	Training for the Employees	Training through third party agencies / OEM	15	Lump sum	10,00,000
4	Services	Satellite Image Procurement	30000	500	1,50,00,000
		Qualified Engineers	8	1500000	1,20,00,000
		Land Base Creation	0	0	0
		Base Map Creation	2110	2000	42,20,000
		33/11 kV SS Survey	371	2500	9,27,500
		33 kV Line / Cable / DT	3217	1750	56,29,750
		11 kV Line/Cable / DT	3415	1750	59,76,250
		LT Network	5620	2000	1,12,40,000
		Pole Painting (RAPDRP Area)	**95000**	150	1,42,50,000
		Consumers	**300000**	35	1,05,00,000
		GIS data preparation / digitisation / vectorisation	2110	3750	79,12,500
		Data Conflation	250	2000	5,00,000
		Migration / Updation (Existing and New)	2110	500	10,55,000
Sub Total (Training + Services) (P)					9,02,11,000
Total (Material + Services)					**9,42,11,000**

- **Expenditure Plan (FY 22)**

Table 2-10 CAPEX FY 22

Sl.No	Components	Material / Activity	Bhubaneswar Circle II + Cuttack Circle (100 % - Landbase		
			QTY / Users	Unit Cost	Amount
1	Hardware	High End Work Station	0	0	0
		Plotter	0	0	0
2	Software and Applications	Mobile Application	0	0	0
		Software Upgradation and Integration with other modules (BOQ as defined under RAPDRP Project and incremental Licenses)	500	Lump sum	4,00,00,000
Total Material Cost (O)					4,00,00,000
3	Training for the Employees	Training through third party agencies / OEM	0	0	0
4	Services	Satellite Image Procurement (Ortho Rectified + Mosaic)	0	0	0
		Qualified Engineers	8	1600000	1,28,00,000
		Land Base Creation	0	0	0
		Base Map Creation	12026	2000	2,40,52,000
		33/11 kV SS Survey	0	2500	0
		33 kV Line / Cable / DT	0	1750	0
		11 kV Line/Cable / DT	30237	1750	5,29,14,750
		LT Network	21697	2000	4,33,94,000
		Pole Painting (RAPDRP Area)	**30000**	150	45,00,000
		Consumers	**1087000**	35	3,80,45,000
		GIS data preparation / digitisation / vectorisation	12176	3750	4,56,60,000
		Data Conflation	150	2000	3,00,000
		Migration / Updation (Existing and New)	12176	500	60,88,000
Sub Total (Training + Services)					22,77,53,750
Total (Material + Services)					**26,77,53,750**

- **Expenditure Plan (FY 23)**

Table 2-11 CAPEX FY 23

Sl.No	Components	Material / Activity	Dhenkanal Circle + Paradeep Circle (100 % - Landbase, LT & Consumer Indexing)		
			QTY / Users	Unit Cost	Amount
1	Hardware	High End Work Station	0	0	0
		Plotter	0	0	0
2	Software and Applications	Mobile Application	0	0	0
		Software Upgradation and Integration with other modules (BOQ as defined under RAPDRP Project and incremental Licenses)	0	0	0
Total Material Cost (O)					0
3	Training for the Employees	Training through third party agencies / OEM	0	0	0
4	Services	Satellite Image Procurement (Ortho Rectified + Mosaic)	0	0	0
		Qualified Engineers	8	1700000	1,36,00,000
		Land Base Creation	0	0	0
		Base Map Creation	14845	2000	2,96,90,000
		33/11 kV SS Survey	0	0	0
		33 kV Line / Cable / DT	0	0	0
		11 kV Line/Cable / DT	0	0	0
		LT Network	9978	2000	1,99,56,000
		Pole Painting (RAPDRP Area)	**30000**	150	45,00,000
		Consumers	**975000**	35	3,41,25,000
		GIS data preparation / digitisation / vectorisation	14995	3750	5,62,31,250
		Data Conflation	150	2000	3,00,000
		Migration / Updation (Existing and New)	14995	500	74,97,500
Sub Total (Training + Services)					16,58,99,750
Total (Material + Services)					**16,58,99,750**

2.12 Summary

GIS integrates both land base and the electrical network maps. GIS is not only useful in improving internal efficiency levels pertaining to power supply monitoring, developing the accurate database, commercial and customer services but also extremely useful for important functions like facility management, energy audit, network analysis, trouble call management, load management, theft detection etc.

At the end of 2023 March, we will be equipped with

1. Sustained GIS database (Land Base, Network 33 kV and below and connected Consumers) covering entire area of TPCODL.
2. Integrated GIS system with Network Analysis, MDAS, SAP ISU, Energy Audit, SCADA, and ADMS.

Considering the amount which is being spent by TPCODL, it is very important to existing and upcoming technologies that GIS should be run and successfully implemented by TPCODL. Without GIS, it is very difficult to generate Accurate Energy Audit, Network Maps and Asset information. From the last 2 years, the data for even mere 428 has not been updated. So, it is strongly recommended that TPCODL should Implement a GIS system and sustain that along with In-house team of 15-20 Members.

GIS is going to help immensely in increasing the operational efficiency of TPCODL as well as help in providing the reliable electricity supply which ultimately reduce the AT&C loss and leads to Customer Satisfaction.

Once GIS is implemented 100% across the area and synchronised with OT System, following benefits will be obtained.

1. Reducing Cycle time of Outage
2. Improvement in Billing & Collection Efficiency
3. Preventive Maintenance
4. Updated Network in near real time enabling system reliability and enhance the safety.
5. Updated Geo Spatial data shall help in identifying the actionable areas for reduction of AT & C Losses on a continual basis.

3 DPR for Smart Meter Implementation

3.1 Background

TPCODL license area is spread over a geography of 29354 Sq. Km and serve the registered consumer base of 2.6 million covering 9 Revenue Districts of Odisha State, namely: Cuttack, Puri, Dhenkanal, Angul, Khurda, Kendrapara, Nayagarh, Jagatsinghpur and part of Jajpur. TPCODL is committed to the followings :

- Reducing AT&C loss.
- Providing better consumer service and value added service.
- Minimizing meter reading error and accurate & timely billing.
- Increase consumer satisfaction by bringing operational efficiency.
- Option of prepaid and postpaid billing in line with government's directive.
- Remote disconnection and re-connection.
- Correct energy audit and saving DTs from getting burnt.

TPCODL proposes Capital Expenditure of Rs 252 Crores. for FY 20-21 to FY 23-24 for implementing SMART metering solutions for its consumers and DTs of rating >=100 KVA.

3.2 Smart Meter :

Smart meter is an advanced energy meter that measures the energy consumption of a consumer and provides added and timely information to the utility company compared to a regular energy meter. Smart meters can read real-time energy consumption information including the values of voltage, phase angle, the frequency & tamper events and communicates bi-directionally on real time basis. Smart meters can communicate and execute control commands remotely as well as locally. It has integrated two way communication modules to facilitate data communication. Need and benefits of the implementation of smart metering is explained in the subsequent paragraphs.

3.3 Objective:

Objective of this project is to rollout smart metering infrastructure in TPCODL license area and to have a better control on revenue generation and revenue protection.To reduce AT&C losses and to ensure revenue from high end consumers, it is proposed to install Smart Meters in consumer with consumption >= 300 units, DTs of rating >=100KVA and all new connections in which three

Phase meters are to be installed from FY 21-22 onwards, though the IT Infrastructure required would be implemented in FY 2020-21 itself.

The table below shows the number of consumers with average monthly consumption more than 300 units :-

Table 3-1: Scope of Smart Meters for Consumers

CIRCLE	Total	AMR	SMART SCOPE
BBSR-1	99641	5678	93963
BBSR-2	32414	1646	30768
CTC	56634	3525	53109
DKL	37535	1157	36378
PDP	24876	834	24042
Total	**251100**	**12840**	**238260**

Table below shows the Circle wise DTs of rating >=100 KVA :-

Table 3-2: Scope of Smart Meters for DTRs

CIRCLE	Total	AMR	SMART SCOPE
BBSR-2	3470	0	3470
CTC	3645	675	2970
DKL	2314	0	2314
PDP	2349	0	2349
Total	**11778**	**675**	**8000**

(Note:- BBSR -1 Circle DTs are excluded as SMART metering is already approved by the Hon'ble Commission)

3.4 Methodology:

3.4.1.1 Capital Investment Plan –

To accrue all the benefits of Smart Meters enlisted in the document TPCODL, through this document, proposed to install Smart Meters on consumers with consumption >= 300 units in a time span of 3 years.

1. Phase 1 – Installation of smart meters for consumers having monthly consumption >=300 units and DTs in BBSR Circle-1.
2. Phase 2 – Replicating SMART Metering for consumers and DTs in remaining 4 Circles (i.e BBSR-2, CTC, DKL & PDP).

This DPR covers the Phase 1 and Phase 2 of implementation of Smart metering in the TPCODL License area. Both Phases will be executed in the span of 3 years from FY 2021-22 to FY 2023-24. Total cost for implementation of Smart metering in TPCODL License area is estimated to be about Rs.252.23 Crore to be spend from FY 2020-21 to FY 2023-24.

Summary of capital investment plan for three years is given below:

Table 3-3: Scope of Smart Meters for DTRs

Period	Meters to be covered	Capex required
	Count	Rs. Cr
FY 2020-21	Only IT Expenditure	115
FY 2021-22 (Meter & IT setup)	80000	
FY 2022-23	80000	67
FY 2023-24	90000	70.23
Total	**250000**	**252.23**

Table 3-4: Proposed Expense for FY 2021-22

Type of Expenditure	No of Meters	Meter Cost	Rs Cr
Single Phase	40000	4500	18
Poly Phase	39000	8000	31.2
LTCT	1000	12000	1.2
Tools & PPE			2.57
Training			2
Total	**80000**		**54.97**

Table 3-5: Proposed Expense for FY 2022-23

Type of Expenditure	Count of Meters (Nos)	Meter Cost	Total Cost (in Crores)
Single Phase	14200	4500	6.39
Poly Phase	60500	8000	48.4
LTCT	5000	12000	6
HT	300	8000	0.24
SAP Integration Cost			5.00
Total	**80000**		**66.03**

Table 3-6: Proposed Expense for FY 2023-24

Type of Expenditure	Count of Meters (Nos)	Meter Cost	Total Cost (in Crores)
Single Phase	14200	4500	6.39
Poly Phase	70500	8000	56.4
LTCT	5000	12000	6
HT	300		
SAP Integration Cost			5.00
Total	**90000**		**73.79**

3.4.2 Capital Investment Schemes –

As mentioned above the implementation of smart metering in TPCODL License area will be executed in three years. In each year TPCODL has planned to replace 80000 no. of meters with smart meters along with installation in all new 3-phase consumers and further smart meters replacement shall be taken up for defective AMR enabled meters.

3.4.3 Statutory requirement:

The present proposal is in compliance with the clause 8.4 (3) of National Tariff Policy dated 28th January 2016 which directs to implement the smart metering. The abstract of the same is as below:

8.4 (3) The Appropriate Commission may provide incentives to encourage metering and billing based on metered tariffs, particularly for consumer categories that are presently unmetered to a large extent. The metered tariffs and the incentives should be given wide publicity. Smart meters have the advantages of remote metering and billing, implementation of peak and off-peak tariff and demand side management through demand response. These would become essential in future for load-generation balancing due to increasing penetration of intermittent type of generation like wind and solar power.

Appropriate Commission shall, therefore, mandate smart meters for:
(a) Consumers with monthly consumption of 500 units and more at the earliest but not later than 31.12.2017;
(b) Consumers with monthly consumption above 200 units by 31.12.2019.

Further, two way smart meters shall be provided to all prosumers, who also sell back electricity to the grid as and when they require.

In order to enable energy audit in the distribution system, all distribution companies shall ensure smart meters in their electricity system throughout the chain from transformers at 132kV level right down to distribution transformer level at 11kV and further down to each consumer. Further, in order to reduce theft of power, the distribution companies should have enabling feature like distribution SCADA with distribution management system and energy audit functions. SERCs shall mandate these to be in place within two years.

In view of the above direction, TPCODL is proposing to install the smart metering infrastructure in its area of license.

3.4.4 Need for Investment:

Smart meter is an advanced energy meter that measures consumption of electrical energy providing additional information compared to a conventional energy meter. The need of this investment is to implement the new technology as proposed by Supply Code 2019. In addition to this Smart metering has significant benefits.

Due to rapid increase in human population in urban area, the demand of electricity has increased, causing increasing power purchase costs during peak hours. Energy conservation has great significance in this scenario of increasing electrical energy demand. Accurate metering, detection of illegal activities, implementation of proper tariff and billing system, timely revenue collection are necessary to ensure economical functions of distribution utility.

Smart meters with Automatic Meter Reading (AMR) system will address the problems of manual collection of meter data, energy deficit during peak hours and opens a channel for the consumers to participate in energy conservation by two-way communication between utility and consumer.

3.4.4.1 Benefits:

1. **<u>From Consumers point of view –</u>**
   - i. Smart metering provides rapid access to all customer transaction and payment records which allow with quick and efficient solution of customer.
   - ii. Day to day bill will be available and thus effective load management by using appliances at off peak hours which will also result in lesser bill.
   - iii. Any tampering with meter is immediately reported to central control. It will reduce theft so tariff rates will go down.
   - iv. Due to remote reading, no need for site visits and hence increases customer's privacy.
   - v. Provides easy pre-payment facility.

vi. LCD display can be programmed to display various facilities including amount of credit left on prepayment system.
vii. The smart meter is an enabler for energy management: empowering consumers to save and manage their energy consumption.

2. <u>From Distribution Utilities point of view –</u>

i. Provides power consumption profile data from individual and groups of meters to facilitate energy management, load research and tariff development.
ii. Provides a low voltage network monitoring system to allow supply outages to be quickly identified resulting in better reliability and improved service levels.
iii. It enables remote meter reading. This eliminates need for site visit to read the meter and reduces the human labor. Timely and accurate meter readings will result into correct billing avoiding consumer complaints.
iv. Any tampering of system is immediately reported. This will reduce losses.
v. Provides a mechanism for the implementation of Demand-Side Management initiatives. This improves energy efficiency and reduces emissions.
vi. Smart Metering will eliminate costs like meter readings, quality checks, billing complaints, payment collection in case of prepayment meters, connection and disconnection wherever applicable.
vii. Remote programming of meter possible (in case of change in tariff, TOD structure, demand interval, billing parameters etc.)
viii. Helps in revenue protection:
ix. Real time feeder-wise, DT-wise energy audit is possible to capture any abnormal deviation.
x. Analytics software will help to detect any metering abnormality immediately. This will ensure reduction in revenue loss, minimum assessment period and thereby minimum consumer complaints.
xi. More effective grid management:
xii. Cases of feeder/DT overloading will be managed effectively and immediately.

3.4.4.2 Technical Justification and details of the project –

As mentioned in the scope this DPR covers all the activities required for implementation of smart metering for TPCODL consumers. Details are as below:

a) Smart Meters –

Smart meters are electronic meters with integrated two-way communication modules to facilitate data communications with the AMI network. General functionality of the smart meters includes:

- Traditional meter reading functions such as consumption, demand, interval & tamper registers. Some meters also include power quality monitoring.
- Two way communication for scheduled and on demand data with AMI system.
- Diagnostics and events processing and communications including self-diagnostics such as faulty memory, firmware issues, event detections e.g. meter tampering, power outage and restoration.
- Remote configurations allow updates to the meter setting such as demand reset, configuration e.g. TOD slots reprogramming and software/firmware upgrade remotely via the AMI communication network.
- Remote disconnect/reconnect - many AMI meters provide the facility for disconnection and reconnection remotely via the AMI communication network.
- Demand limiting - some AMI meters allow the utility to set/reset demand limits in the meters remotely; the integrated disconnect switch will be activated automatically when the demand limit is exceeded.

b) Meter data management software

- MDM is the central repository for all type of data from all consumer meters covered under AMR or AMI.
- The MDM system can maintain and process the repository of all meter data such as interval usage data, event logs, register data & outage history for all the connected meters.
- The system will have the facility to manually enter the data of meters which could not be read through AMR system.
- The system will also have a facility to upload meter data collected through MRIs.
- MDM system will be integrated with billing system and data analytic system and other IT/OT systems etc.

c) Data Analytic System

Data analytic tool shall carry out various functions as given below:

- Data visualization with analytics enables to discover meaningful insights of data
- Generation of Dashboards and actionable reports.
- Fast processing of large amount of data
- Consumer category wise average load curve
- Reports to detect theft and tamper
- Report to detect abnormality in meter and metering circuit.

- Various types of graphical representation for consumption data.
- Data loading from various sources
- Any logic can be changed by user without any dependency from IT

d) Back-end IT infrastructure –

Back end IT infrastructure consists of various components to set up AMI infrastructure. These components include DCU/routers, Head End Systems, servers, storage, database licenses, security devices etc.

3.4.5 Capex requirement:

The breakup of the Capital Expenditure is as given in the Table below

Table 3-7: Breakup of Capital Investment

Type of Smart Meters	Count of Meters	Cost of Meter (including installation)	Total Cost of Deployment (Rs Cr)
Back End System Cost	2.5 Lakh end points (+ 20% margin)		50
Single phase	68400	4500	30.78
Whole current poly phase	170000	8000	136
LT CT + 8000 DT's	11000	12000	13.2
HT CT	600	8000	0.48
SAP Integration cost & AMI License fee			10
Cost of Tools and PPE			2.57
Cost incurred towards employee training & development of training yards for practice of BA employees			2
Contingency cost @3%			7.35
Grand Total	**250000**		**252.4**

Year 1 In first year i.e FY 2020-21, it is planned the incur expenditure towards back end system cost & IT systems and also includes setting up of Smart Meters towards DTs (4000 Nos)

Year 2 -it is planned to cover around 80,000 meters–

Year 3- In second year 80,000 meters shall be covered.

Year 4- Remaining 90,000 meters will be installed.

3.4.5.1 Smart Tools Requirement for Smart Meter Implementation Drive:

Smart Meter installation requires smart tools in order to maintain the already achieved level of safety & quality standards. The Smart tools primarily comprises of Cordless Box Battery Operated Spanner cum Impact Wrench, Cordless Battery Operated Driver cum Drill, Hammer Battery operated CRH Drill Machine etc. These Smart tools being battery operated, will reduce the physical human work thereby improving the meter installation cycle time and quality of workmanship. The cost of such Smart tools will be approx. Rs 2.57 Crores.

Table 3-8: Breakup of Smart Tools

S.No.	Material	Per item cost	Requirement (count)	Amount in Cr. (excluding taxes)
			FY 21-22	
1	Cordless Box Battery Operated Spanner cum Impact Wrench	39810	250	1
2	Cordless Battery Operated Driver cum Drill	16320	250	0.41
3	Hammer Battery operated CRH Drill Machine	46865	250	1.17
Total				**2.57**

3.4.5.2 Assumptions:

The Cost of meter considered for calculation is based on the unit cost of meter considered by Tata Power Delhi Distribution Ltd and Tata Power, Mumbai under their approved DPR. However while actually procuring meter TPCODL will follow the open tendering process for procuring meters

3.4.5.3 Process for Procurement of Equipment to ensure least cost option:

TPCODL follows a very detailed, systematic procurement process that ensures transparency and competition resulting in procurement of material and services at Competitive Prices. All the activities related to procurement of materials as well as services right from budget availability till preparation of purchase order has been configured through workflow in SAP ERP.

For ensuring least cost option, as per the directives of the Hon'ble Commission, we are following open tendering process which has been evaluated by applicable technical and financial expertise. The vendors had been finalised based on the best technical and commercial offer.

3.4.6 Expected Financial Benefits : -

An estimated annual saving under various heads are mentioned in table below:

Table 3-9: Key Financial Benefits

Key Financial Benefits				
Head	**Cost per Unit / EA**	**Count**	**Cost Savings per annum with DPR-2 Deployed Rs. Cr.**	**Assumptions**
Saving Meter Reading and collection Cost	20	2,38,000	5.71	Total Population of Smart Meters Installed
Savings in manual Data Downloading cost	100	24,000	0.24	It is considered that 10% cases will be downloaded annually due to non-communication
Savings Meter Disconnection Cost	300	6426	2.31	1. 30% DO are generated of total population 2. 30 % of DO are converted to DA. 3. 30% of DA are executed as MRO per month.
Savings @ Commercial loss - Theft detection	18500	5 MW	4.6	1. Average recovery per KW is Rs. 10000. 2. 20 MW is the load booked per year. 3. 50% of the revenue is considered from the cases under consideration. 4. 18500 is Avg. Amount recoverable against 1 KW theft in LT Ind, GP & Domestic category.

Total Savings (Annual) excluding savings of Distribution Loss	**12.86Cr**	

In view of the above, Hon'ble commission is humbly requested to consider and approve Rs.252.23 Crore for installation of 2,50, 000 smart meters.

4 DPR for Deployment of New SCADA System for TPCODL Network

4.1 TPCODL Roadmap

Tata Power's competence in adaptation of latest technology makes it very appropriate to take initiative to lead conceptualization and implementation of state of the art automation technologies in TPCODL. Further, TPCODL has always the quest for adapting new technologies to provide quality customer services, manage revenue cycle processes for reduction of AT&C losses and efficiently manage to deliver highly reliable and improved quality supply in safe manner to its consumers by meeting various standards of operation. By using Supervisory Control and Data Acquisition (SCADA) & Advanced Distribution Management System, the company intends to monitor the 33 / 11 kV Sub-stations and network on real time basis and do necessary analysis functions to ensure the network reliability and availability through proactive remedial actions either by logic-based intelligence or through manual system to reconfigure the network.

4.2 Area of Operation

Licensed area of TPCODL comprises of 9 revenue District of Odisha, namely: Angul, Cuttack, Dhenkanal, Jagatsinghpur, Kendrapara, Khordha, Nayagarh, Puri and part of Jajpur and is spread over the geography of approx. 29354 Sq. Km serving the consumer base of approx. 2.6 million ranging from Industrial to Economically weaker section customers. The operational area is spread over 5 Circles & further into 20 Divisions with 371 Nos. of 33/11 kV Primary Sub-Stations as of date.

The table below explains the operational area with name and number of Circles and Divisions.

Table 4-1: Area of Operation (Circle, Division & Number of Substations)

Circle Name	Division Name	Number of Primary Sub-Stations	Total S/s in the Circle
Electrical Circle No-I, Bhubaneswar	Bhubaneswar City Distribution Division-I (BCDD-I)	9	71
	Bhubaneswar City Distribution Division-II (BCDD-II)	25	
	Bhubaneswar Electrical Division, Bhubaneswar (BED)	15	
	Nimapada Electrical Division, Nimapada (NED)	22	
Electrical Circle No-II, Bhubaneswar	Khordha Electrical Division, Khordha (KHD)	28	90
	Balugaon Electrical Division, Balugaon (BAED)	12	
	Nayagarh Electrical Division, Nayagarh (NYD)	24	
	Puri Electrical Division, Puri (PED)	26	
Electrical Circle, Cuttack	City Distribution Division, Cuttack (CDD-I)	14	75
	City Distribution Division, Cuttack (CDD-II)	17	
	Cuttack Electrical Division, Cuttack (CED)	16	
	Athgarh Electrical Division, Athgarh (AED)	16	
	Salepur Electrical Division, Salepur (SED)	12	
Electrical Circle, Dhenkanal	Dhenkanal Electrical Division, Dhenkanal (DED)	30	70
	Talcher Electrical Division, Chainpal (TED)	25	
	Angul Electrical Division, Angul (ANED)	15	
Electrical Circle, Paradeep	Kendrapara Electrical Division, Kendrapara (KED-I)	24	65
	Kendrapara Electrical Division, Marshaghai (KED-II)	10	
	Jagatsinghpur Electrical Division, Jagatsinghpur (JED)	18	
	Paradeep Electrical Division, Paradeep (PDP)	13	
		Total Numbers of Sub-stations	**371**

4.3 Existing SCADA System

The existing SCADA system is implemented under R-APDRP (Part-A) and designed for 60 and 44 nos. of Sub-station at Bhubaneswar and Cuttack respectively. However, with Phase 1 and Phase 2 of "SCADA Deployment Plan", the existing SCADA System will handle 110 nos. of Sub-stations, which will exhaust the current capacity of the systems installed.

In addition to 110 nos. of substations, we require to integrate additional 261 nos. (Appx.) 33/11 kV Sub-station. Thus, the existing SCADA System needs to be augmented for 500 nos. of Substation instead of 110 nos. of Sub-stations. It is imperative that required number of Input / Output Signal counts will increase, and the existing SCADA System does not have sufficient capacity to accommodate another 261 nos. of Sub-station and addition of future sub-stations. To meet this requirement existing SCADA System needs up gradation of Hardware and Software license with existing functionalities. Similarly, the existing SCADA System of Puri, which was supplied by Schneider, will also require up gradation to meet the growth plan in that area. Limitation of the Existing SCADA Systems are following:

- Multiple System i.e. independent system at Bhubaneswar, Cuttack and Puri
- Standalone System at each control centre
- No data exchange between the system
- The upgradation may require new SCADA software version, which may also require latest hardware considering compatibility and capacity
- Independent Data exchange with enterprise level system and with other utilities (SLDC, OPTCL)
- Independent inventory and maintenance practices
- Operation and Maintenance resource development for each system. Restrict the optimization of resources.
- Cyber Security risks compounded due to distributed architecture with multiple system and interfaces at each Control Centre.
- Dependency on the existing system providers.
- Upgradation cannot be done by any other agency than OEM. This will not provide opportunity to save the cost through open tendering as it will be a single party order.

Figure 4-1: Current Operation Philosophy

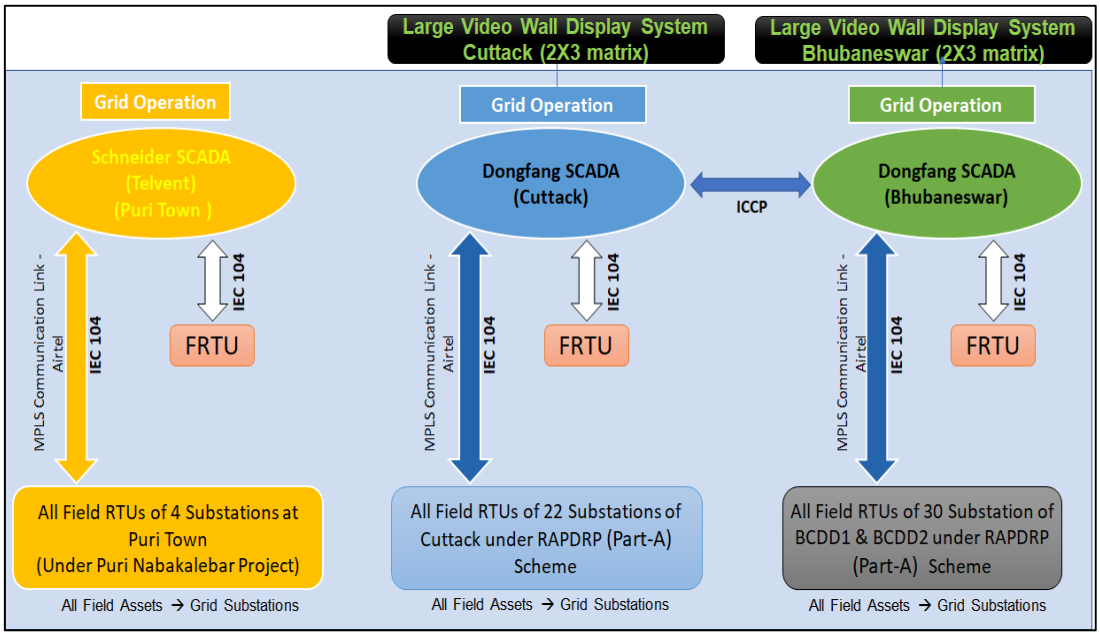
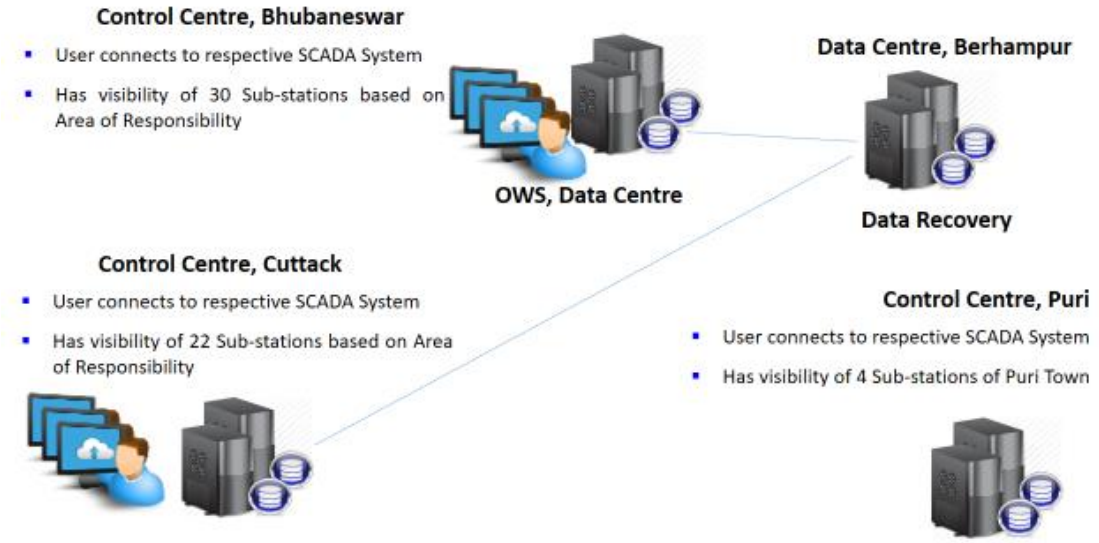


Figure 4-2:As is Status of SCADA Systems at TPCODL



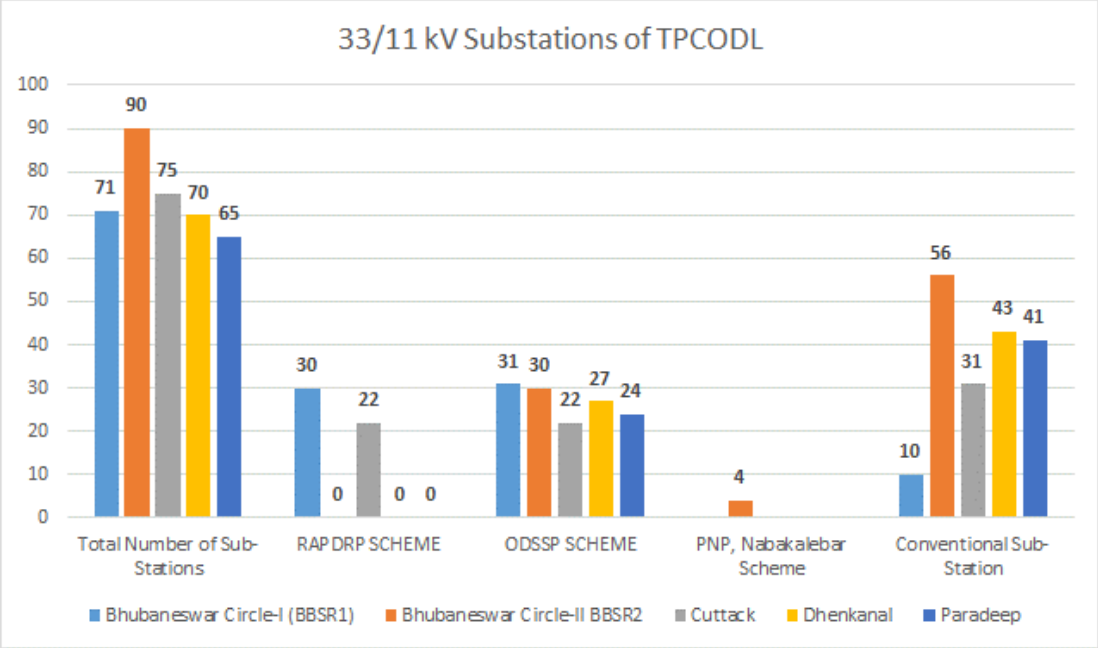
4.3.1 Substations Covered under Different Schemes in Respective Circles

As the TPCODL distribution area is spread over in 5 Circles, 20 Distribution Divisions and 64 Sub-divisions with 371 numbers of 33/11 kV Primary Sub-Stations. The substations are implemented under various schemes and broadly categorized as under:

Table 4-2 :Sub-Station Details, Under Scheme Implemented

33/11 kV Sub-Stations of TPCODL					
Circle	**Total Number of Sub-Stations**	**RAPDRP SCHEME**	**ODSSP SCHEME**	**PNP, Nabakalebar Scheme**	**Conventional Sub-Station**
Bhubaneswar Circle-I (BBSR1)	71	30	31		10
Bhubaneswar Circle-II BBSR2	90	0	30	4	56
Cuttack	75	22	22		31
Dhenkanal	70	0	27		43
Paradeep	65	0	24		41
	371	**52**	**134**	**4**	**181**

Figure 4-3:Substation Implemented Under Various Scheme



4.3.1.1 SCADA Enabled Sub-station

Out of 371 nos. of Substations, 190 nos. of sub-Stations are SCADA enabled and can be remotely monitored and controlled from SCADA System. Since these systems are implemented under various schemes all stations are not integrated with SCADA System. Since automation has been carried out under various scheme and at different time lines, systems of different OEMs (Example ASHIDA, ABB, SIEMENS, DONGFANG, Schneider Electric etc.) are in place.

Details of automation of Sub-Station and integration with SCADA System is described under this section.

4.3.1.2 Sub-station Automation System under RAPDRP Scheme

Out of 190 nos. of 33/11 kV SCADA enabled Sub-stations, 56 nos. of Sub-stations are remotely monitored and controlled from 3 nos. of independent Control Center located at Bhubaneswar, Cuttack and Puri town. These Control Centres are established under following schemes:

Table 4-3 SCADA Enabled Substation integrated with SCADA System (Presently)

Existing Control Centre Details			
Sl. No.	Control Centre Location	No. of Sub-Stations Covered	Established under Scheme
1	Bhubaneswar	30	Part-A, R-APDRP
2	Cuttack	22	Part-A, R-APDRP
3	Puri Town	4	PNP - Puri Nabakalebar Project

56 Nos. of substations under RAPDRP and PNP Nabakalebar scheme are automated and equipped with 33/11 kV CRPs, Numerical Relays, VCBs, Battery Charger and Multi-Function Meters (MFMs). All these devices are integrated at sub-station level RTU. The numerical relays and Multifunction meters are communicating with RTU over IEC 61850/IEC-103 and Modbus protocol respectively. Equipment status, alarms and control are through BCPUs over IEC61850 and status of auxiliary system are provisioned through hardwiring to RTU. These RTUs are communicating to respective control Centre SCADA System i.e. Bhubaneswar, Cuttack and Puri over IEC60870-5-104 using service provider MPLS network.

These substations are lagging in terms of having CCTV, Security System, Access Control, Civil Boundary, Fencing and old equipment which need to be installed or replaced in a period of time.

4.3.1.3 Sub-station Automation System under ODSSP Scheme

The ODSSP scheme has focused on supply of quality power to consumers and intends to address the problem of low voltage in rural areas. The scheme focusses on construction of 33/11 kV Sub-stations in the state; over 134 Nos. of 33/11 kV sub stations has been planned to commission under three phases. Out of 134 nos. 33/11 kV Substation, 72 Nos. of Sub-stations are commissioned and handed over to TPCODL for operation. Substations built under ODSSP scheme are capable of GSAS, but they are not SCADA/ ADMS controlled. Presently these Sub-stations are manned and locally monitored and controlled under the instruction of Area In charge. These substations are lagging in terms of having CCTV, Security System, Access

Control, Civil Boundary, Fencing and old equipment which need to be installed or replaced in a period of time.

However, these substations are automated and equipped with 33/11 kV CRPs, Numerical Relays, VCBs, Battery Charger and Multi-Function Meters (MFMs). All these devices are integrated at sub-station level with Data Concentrator Unit (DCU) or RTU. The numerical relays and Multifunction meters are communicating with RTU over IEC 61850 and Modbus protocol respectively. These RTUs are compatible with communication to any Central/Standalone SCADA System over IEC60870-5-101/104.

To achieve remote monitoring and control through SCADA system, 21 nos. of ODSSP sub-stations are planned to be integrated with the existing SCADA System by establishing the communication link from each substation to Control Centre. It is proposed to integrate the Critical/Urban/Industrial sub-station of ODSSP scheme first. The remaining Sub-stations (113 nos.) can be integrated to the proposed SCADA System in next FY 2022.

It is to be noted that, the design capacity of the existing systems under R-APDRP Scheme is limited to 100% expansion i.e. the SCADA System at Bhubaneswar is primarily designed to accommodate 30 sub-stations, so this system can additionally accommodate another 30 Sub-stations. Similarly SCADA System at Cuttack is primarily designed for 22 Sub-stations, hence additionally 22 nos. of the ODDSSP sub-stations can be further integrated to the Cuttack system, same with Puri system, 4 nos. additional Sub-station can be integrated with the existing SCADA System of Puri town.

In line with existing practice of using services of Communication network provider such as Airtel, Vodafone for connectivity of substation under RAPDRP to Control Centre, the communication infrastructure for these 319 nos. of sub-stations is also planned in the similar manner i.e. taking services of MPLS/VPN service provider.

4.3.1.4 Conventional Sub-station

In TPCODL there are approx. 181 Nos. of 33/11 kV conventional Sub-stations, which are very old and poor in conditions in terms of electrical structure, equipment and civil infrastructure. Majority of these grids are with single Incomer with no concept of 33 kV Bus Coupler and most of the equipment completed their operational life, 11 kV feeders are Group Controlled through single VCB, damaged jumpers and under rated conductor etc. are being used in bus bar and switchyard. Also, the Sub-station and Control Room earthling system are in bad condition and leading to poor reliability and safety.

On physical aspect of 33/11 KV substation, conditions of Boundary Wall, Fencing, Gravels, Trench covers, are in bad shape. There are many 33/11KV substation in low lying area, hence this lead to water logging in raining season. There is public entry inside the grids without obstruction, this is very serious situation with respect to equipment and public safety.

To automate these sub-stations for remote monitoring, phase wise implementation plan for automation and addressing of all the above mentioned observations are prepared, which are described in the subsequent section of this document.

4.3.1.5 SCADA/DMS System at Bhubaneswar and Cuttack Town:

The SCADA/DMS System is implemented in Bhubaneswar and Cuttack Town of TPCODL under R-APDRP (Part-A) Scheme in the year 2016. TPCODL awarded the contract to M/s DongFang Electronics Co. Ltd. (DFE) as the SCADA/DMS Implementation Agency (SIA) for execution and implementation of SCADA/DMS in Bhubaneswar and Cuttack town. (Please Refer Fig-01)

Some major components and functionalities of SCADA/DMS System are given as below:

- Independent SCADA/DMS Control Centre (SCADA CC) at Bhubaneswar and Cuttack
- Disaster Recovery (DR) Centre at Berhampur for Data Recovery
- DF8000 SCADA/DMS System have the following functions:
- SCADA Applications
- Information Storage and Retrieval (ISR)
- DMS Applications
- Integration with R-APDRP Customer Care, GIS, Billing System & SLDC

In addition to SCADA / DMS implementation, the Remote Terminal Units were also installed at 56 nos. of 33 / 11 kV Substations. These RTUs was integrated over MPLS / VPN link with the respective Control Centres (CC) located in Bhubaneswar, Cuttack and Puri town. The protection BCPUs of 33 kV and 11 kV feeders are integrated to the respective RTUs on IEC61850. The Digital Input / Output (Status, Open/Close/Reset/Tap Change control, Protection Alarms) of the respective bay are acquired through these BCPUs on SCADA System. For monitoring of the Analog measurement, separate Multifunction Meters are used, which are integrated to the Station RTU over MODBUS (Serial) Protocol. The Communication link for integration of these RTUs is MPLS network of the Network Bandwidth Service Provider (i.e. Airtel).

In addition to BCPUs of the 33 kV and 11 kV feeders, some of the installed FRTUs of RMU and data concentrators of FPI of the 33 kV/11 kV network are also integrated with the respective SCADA System. The FRTUs and data concentrators of FPIs are communicating over GPRS/SIM modems for remote monitoring and control through respective SCADA System as applicable.

4.3.1.6 SCADA/DMS System at Puri Town:

The SCADA/DMS/OMS System is implemented in Puri Town of TPCODL under Puri Nabakalebar Project (PNP) funded by State Government in the year 2014-15. OPTCL was appointed as the Nodal agency for execution of the PNP project. Further, OPTCL awarded this project to M/s L&T as EPC contractor. M/s L&T further subcontracted to M/s Schneider Electric for the Implementation of SCADA/DMS/OMS system. (Please Refer Fig-01)

The implementation scope of SCADA/DMS/OMS system also includes Sub-Station automation system of four numbers of 33/11 kV GIS sub-station, FRTUs of RMUs & CSS are connected over Fiber Optic communication link and Data Concentrator Units of FPIs over GPRS/SIM Modems for remote monitoring and controlled through this system.

4.4 Deployment of New SCADA System

Currently there is no concept of Centralised Power System Control Centre or Area Power System Control Centre in TPCODL, as a centralize agency to monitor the network and coordinate the network operations in real-time. There is a strong need to setup the Centralised Power System Control Centre along with Area Power System Control Centre to coordinate the network operations in real-time by implementing state of the art technologies available in the market for distribution network.

In view of Centralised Monitoring and Control of the entire distribution network, it is proposed to replace the existing SCADA System to cover the entire TPCODL distribution network covering all the 5 circles i.e. Bhubaneswar-I, Bhubaneswar-II, Cuttack, Dhenkanal and Paradeep comprising of 371 nos. of 33/11 kV Primary Sub-Stations.

The purpose and necessity for replacing the existing SCADA system is as follows:

4.4.1 Architecture of existing SCADA

The existing SCADA Systems architectures are of standalone type and monitoring & controlling their respective substation present in each town. The existing SCADA System functionalities are limited and designed as per the Model Technical Specification (MTS) of R-APRDRP. Moreover, there is no concept of MCC and BCC.

4.4.2 License Enhancement

The existing SCADA System do not have sufficient capacity to accommodate another 261 nos. of Sub-station or all sub-stations of TPCODL. So, for enhancing the SCADA System needs upgradation of Hardware and Software license, to meet the performance parameters for real-time CPSCC monitoring and operations.

4.4.3 Aged Hardware and Software

Typical life of IT hardware and software is about 5 to 7 years. The existing SCADA System hardware is around 4 years and is going to be obsolete in a year or two. The aged hardware is resulting in frequent failures. The repairing & replacing of the defective part has become difficult

day by day with no support from OEMs. The failure of hardware results in impairment of OS & SCADA applications and functionalities.

Further, the Operating System (OS) of Servers and Workstations, SCADA Software have reached their End of Life (EOL). In case of malfunctioning of the software or removal of bug for normalcy and patch updating has become very difficult which impacts impairment of SCADA applications and functionalities.

With this objective of ensuring reliable power supply and ensuring best customer services to the end consumers, TPCODL has come up with capital investment addressing the following major functional requirement:

a. Centralized System for visibility of the entire distribution network.
b. Enables standardized Data Acquisition and Reporting.
c. Perform all critical system operations including routine and emergency operations with enhanced operational availability of distribution network and reliable power supply to customers.
d. Predictive and Analytical tools for efficient management and decision making for the entire distribution network.
e. System supporting Cyber Securities management through Centralized Account Management, domain controller, IPS & IDS, User Authentications, Network Segmentation, Access Control, Route and Traffic Control, Implementation of Trust Boundaries, OS upgradation, patch management of application and OS, monitoring of real-time alert of compromise and potential compromise

The Centralized System will provide common training platform for systems and maintenance of assets.

a. Enhanced Operational safety.
b. Implementation of adequate Network Management and Cyber Security measures.
c. Database generation, preparation for entire network centrally, causing standardization across network.

4.5 Proposed Operation Philosophy

Present PSCC at Kalyani complex, Bhubaneswar is having limited space and it will not be feasible to monitor all substations. So a new spacious building is required to set up MCC and PSCCC for remote monitoring of all substations.. Please refer **to Annexure-1: Proposed Architectures at MCC & APSCC**

For Centralize monitoring of the entire network and co-ordinating the network operations in real time, there is a strong need to setup the Centralised Power System Control Centre along with

Area Power System Control Centre by implementing state of the art technologies available in the market for distribution network.

In view of centralised monitoring and control of the entire distribution network It is proposed to replace the existing SCADA system (Existing SCADA systems covering only some part of the Bhubaneswar Circle # 1, Cuttack and Puri town network ***(Please Refer* Figure 4-1 *and* Figure 4-2 *for the existing SCADA system Setup and operation philosophy)*** to cover the entire TPCODL distribution network covering all the 5 circles i.e. Bhubaneswar # 1, Bhubaneswar # 2, Cuttack, Dhenkanal and Paradeep comprising of 371 nos. of Primary Sub-Stations.

The proposed Automation system will enhance the Network Security, Reliability of Grid Operation, Information Exchange, Operator Guidance & Decision Making, and will enable economical network operation.

Apart from standard SCADA functions, the proposed System shall perform advance distribution management applications such as State Estimation, Load Flow computations, Energy Accounting, computation of Performance Indices (CAIFI, SAIFI, and SAIDI etc.), Network Coloring, Power Quality monitoring etc.

It is also envisaged to implement in next phase applications such as Switch Order Management, Outage Management and Work Force Management for entire distribution network to ensure availability and reliability of the network and optimal utilization of the resources. Additionally, the proposed system will also address the requirement of Cyber Security, Centralized Time Synchronization of RTUs, FRTUs & IEDs across the network, interfacing with other enterprise applications such as GIS, ERP, Network Planning tools installed/planned in TPCODL through enterprise level bus on open protocol for MIS reporting, Preventive maintenance, data analysis, network planning, asset management etc. With the entire suite of applications, the system will enable the Control Room Engineer and other functions of the organization, the complete visibility of the network for faster restoration, quick decision making and optimal utilization of the network and equipment. Tata Power has implemented similar kind of System at Mumbai & Delhi.

Considering the wide spread of the network, it is proposed to segregate the 33 and 11 kV network operations i.e. All 33kV operations will be carried out from the CPSCC at Bhubaneswar, whereas 11 kV network operations are planned to be operated from the respective APSCC considering the density of the network i.e. Bhubaneswar#1, Bhubaneswar#2, Cuttack, Dhenkanal and Paradeep.

4.5.1 Central Power System Control Centre (CPSCC)

CPSCC would work as a central agency for Control & Monitoring of 33 and 11 kV Network, and in due course will migrate from the manual to remote operations of 33 /11 kV Substations in a phased manner.

Centre Power System Control Centre (CPSCC) at Bhubaneswar would be established with 24 x 7 Desk Operations for whole of 33 kV Network of the license area. This would be nodal agency for coordination with OPTCL and the O&M Zones. All the monitoring & operations at 33 kV level and issue of PTW will be affected from CPSCC. In the initial phase, this would be a coordinating agency and central agency for issuing PTWs on 33 kV network in coordination with OPTCL and O&M Zones. In the course of time as the 33 /11 kV substations are tested for remote monitoring & operations, all the operations for 33 kV level in the license area would be carried out remotely through SCADA by CPSCC except at the emanating point at OPTCL Grid.

In the event of a 33 kV tripping, the concerned SDO will communicate with CPSCC for test charging, charging the feeder after repairs and issuance and clearance of the PTW. CPSCC in turn will discuss and take up with the concerned OPTCL Grid for taking it further in terms of test charging and issue of PTW in the event of a breakdown for repairs and further for charging the feeder after repairs on clearing of PTW. At no point of time, operations at 33 kV level is envisaged in isolation by SDO and OPTCL without the consent of CPSCC.

In case of a tripping or outage required for a 33 kV feeder concerned authority shall discuss and obtain appropriate instructions from CPSCC to coordinate all operations and PTW process at 33 kV level.

4.5.2 Area Power System Control Centre (APSCC)

Similarly, Area Power System Control (APSCC) would be established for each of the 5 geographical circles and these would in turn be also manned 24 x 7 for Desk Operations. These would be the nodal agency for coordination with the O&M Zones for network operations. All the operations at 11 kV level and issue of PTW will be from APSCC. In the initial phase, this would be a coordinating agency and central agency for issuing PTWs on 11 kV network in coordination with the O&M Zones. In the course of time as the 33 /11 kV substations are tested for remote operations, all the operations for 11 kV level in the license area would be carried out by the respective APSCC`s.

In case of a tripping or outage required for an 11 kV feeder concerned authority shall discuss and obtain appropriate instructions from APSCC to coordinate all operations and PTW process at 11 kV level.

In the event of a 11 kV tripping, the concerned JM / 33-11 kV Substation will communicate with APSCC, on intimation APSCC in turn will take up with the concerned JM for taking it further in terms of test charging and issue of PTW in the event of a breakdown for repairs and further for charging the feeder after repairs on clearing of PTW. At no point of time, are

operations at 11 kV level to be done in isolation by JM and 33 /11 kV Substation operator without APSCC In loop.

All the operational parameters in terms of outages, breakdowns, interruption for the 33 and 11 kV network across the License are would be monitored by CPSCC /APSCC. A daily report of the network condition in the form of Flash Report would be circulated by PSCC for the Management & across the Zones. These would also be published on a monthly basis with analysis.

As these processes get stabilized, day ahead scheduling of power, real time monitoring & control of power, Management of Outages will also form a part of the CPSCC/APSCC in coordination with the Power Management Group.

MCC and APSCC Systems shall be operational during normal operation as independent sites. Thus, the primary source of data for MCC and APSCC shall be local endpoint source (i.e. Gateways, RTUs, FRTUs or ICCP).

Control's for Stations/Gateways/RTUs/FRTUs or ICCP shall be based on AORs and shall transferred to either control Center as per operational needs or communication link failure to either site. Controls for a particular Area of Responsibility (AOR) shall be active only at one site at any given time.

However, proposed system will support the scenario of operation i.e. operators logged into MCC can control one part of TPCODL's Power network independently and operators logged into APSCC can operate another part of the network. Controls for a particular AOR shall be active only at one site at any given time.

Any shift in operational control between sites will be logged as an event and archived to historian.

4.5.3 Deployment plan of Substation Automation and SCADA\ADMS\OMS\WFM

Evolution of Automation for T&D network, the process by which the control systems have transformed from manual operation to remote operation through Human Machine Interfaces (HMI) has resulted in increased reliability, accuracy and dependability of the systems and minimized the errors caused by manual control.

TPCODL over the years has adopted latest technologies and has installed the best-in-class equipment. To effectively utilize & sweat these assets, there is a need for centralized control and remote operations of TPCODL distribution network and related maintenance and manning philosophy.

To perform, all critical system operations including routine and emergency operations with enhanced operational availability of distribution System and reliable power supply to customers, the present infrastructure & technology available in TPCODL to handle all these systems is insufficient.

As per the operation philosophy discussed above in Item 7.0, it is proposed that the Centralized Power System Control Centre (i.e. MCC) be established at Bhubaneswar. Considering the vast geography of the distribution network, it is also proposed to have Area Power System Control Centre at five Circles i.e. at Bhubaneswar # 1, Bhubaneswar # 2, Cuttack, Dhenkanal and Paradeep. To ensure integrity in system operation of Distribution network, it is necessary to operate the entire TPCODL distribution network from central place. This will ensure efficient operation and monitoring under steady state, Dynamic & Transient condition of the system.

To meet the present and future requirement there is an urgent need to replace the system with advanced functionalities, analytical tools for Power system operation to tackle steady state, dynamic and transient conditions of vastly spread and complex distribution network to have a bird's view of entire distribution network and to deliver the continuous and reliable power supply to consumers.

The proposed system will be designed for monitoring and control of 500 nos. of 33/11 kV substations from MCC (CPSCC at Bhubaneswar) and APSCC at Bhubaneswar-1, Bhubaneswar-2, Cuttack, Dhenkanal and Paradeep.

To finalize the way forward for SCADA system i.e. augmentation of the existing SCADA / ADMS or to implement new Centralized System, further technical evaluation was carried out with the following approach, methodology, advantages and disadvantages.

4.6 Purpose and Necessity of New SCADA System

The purpose and necessity for replacing the existing SCADA system is as follows:

4.6.1 Architecture

The existing SCADA Systems architectures are of standalone type and monitoring & controlling their respective substation present in each town. The existing SCADA System functionalities are limited and designed as per the Model Technical Specification (MTS) of R-APRDRP. Moreover, there is no concept of MCC and BCC.

4.6.2 License Enhancement

The existing SCADA System do not have sufficient capacity to accommodate more than 200 nos. of Sub-station or all sub-stations of TPCODL. So, for enhancing the SCADA System needs up gradation of Hardware and Software license, to meet the performance parameters for real-time CPSCC monitoring and operations.

4.6.3 Aged Hardware and Software

Typical life of IT hardware and software is about 5 to 7 years. The existing SCADA System hardware is around 4 years and is going to be obsolete after few years. The aged hardware is resulting in frequent failures. The repairing & replacing of the defective part has become difficult day by day with no support from OEMs. The failure of hardware results in impairment of OS & SCADA applications and functionalities.

Further, after few years the Operating System (OS) of Servers and Workstations, SCADA Software have reached their End of Life (EOL). In case of malfunctioning of the software or removal of bug for normalcy and patch updating has become very difficult which impacts impairment of SCADA applications and functionalities.

4.6.4 Deployment of New SCADA System

The current requirement of operationalization of existing sub-stations (110 Nos. of S/s) can be achieved from the standalone existing systems. However, as a long-term plan "Deployment of New SCADA System" is required to monitor all substation of entire TPCODL network. So approval for complete revamping of the existing systems with new advance SCADA system addressing the following major functional requirement is solicited.

- Visibility of the entire distribution network centrally
- Centralized Main Control Centre (CPSCC) with Area Power System Control Centre.
- Perform all critical system operations including routine and emergency operations with enhanced operational availability of distribution network and reliable power supply to customers
- Implementation of adequate Network Management and Cyber Security measures.
- Predictive and Analytical tools for efficient management and decision making for the entire distribution network
- System supporting Centralized Account Management, domain controller, IPS & IDS, User Authentications, Network Segmentation, Access Control, Route and Traffic Control, Implementation of Trust Boundaries, OS upgradation, patch management of application and OS, monitoring of real-time alert of compromise and potential compromise
- The Centralized System will provide common training platform for systems and maintenance of assets.
- 100 % Data Synchronization between MCC and APSCC ensuring data accuracy
- Enhanced operational safety

4.6.5 Benefits with the Deployment of New SCADA System:

- Centralized System for entire distribution network

- Suitably integrate/replace multiple makes and models of SCADA/Local SCADA system that were implemented across various control centre / sub-stations during different point of time.
- MCC and Nodal CC will be installed and commissioned at separate location simultaneously, the outage of existing system will have least impact on current controls and operations while change over to new SCADA system.
- Commissioning, administration, data congruency, tag alignment and response to power system additional/changes will be easier
- Enables standardized data acquisition and reporting
- Effectively utilize the assets and serve customers efficiently and economically
- Common look and feel (Screens, Commands & Toolkits) for operations across various locations.
- Data exchange with enterprise level system and with other utilities (SLDC, OPTCL) centrally
- Common inventory and maintenance practices
- Optimization of operations and Maintenance resources
- Additional functionalities such as Fault analysis, Occurrence Analysis and Energy Management can be included for faster analysis and decision making for restoration of distribution network after occurrence/fault.
- Analytical functions wherein one can study the trend, pattern and predict thereby system response and condition
- Additional Operator Workstations can be installed at any of the location to access the data by logging to MCC & APSCC SCADA System with proper authorization and area of responsibility and with adequate access protection for local monitoring and control.

4.7 Benefits of the Project

4.7.1 Tangible and Intangible benefits

Centralized operation would ensure optimum resource utilization of the hardware and software and functionalities used in the SCADA System. Other benefits include:

- This will ensure efficient operation & monitoring under steady state, dynamic & transient condition of the system.
- To achieve improvement in operations considering complex Load- Demand cycle changes to bring in better and holistic visibility while making critical decisions.
- Optimize on unscheduled power interchange, maximize utilization of the assets
- Better Inventory management, low maintenance cost
- Ease of Operation and Operational flexibility
- Multi-skilling of operational and maintenance personals
- Enhanced operational safety

- Using the latest Operating systems, with enhanced functionalities, enabling Analysis and Power System studies/event analysis including Integrated Graphical User Interface (GUI) for SCADA, ADMS and other applications which would be uniform across all substations and would be cyber security compliant for IT/OT integration requirements of the future.
- With common system interfaces it brings in optimized resource management, common training platform for systems, and maintenance of assets. Avoidance of multiple systems in OS and software is also affected.
- Data exchange with redundancy to any external system
- Better Control on Cyber Security Management, optimization of cyber security measures implementation
- Better Data Synchronization between MCC, APSCC, ensuring data accuracy, availability and reliability
- N-2 Communication redundancy will be provided at critical location for communication by using advanced MPLS Technology
- Improved reliability of service
- Better Integration and coordination with enterprise system to provide relevant information to those internal & external users that rely on accurate information in a timely manner

4.7.2 Benefits to Customer

- Reduction in restoration time of outage
- Improved reliability of service
- Better control of power quality and enhanced use of reactive power sources
- Useful feedback information to the customer in terms of expected outage duration time etc.
- Monitoring the potential quality problems and also the reliability problems due to supply interruptions.

4.7.3 Indirect Savings/Improvements

- Reduction in overall maintenance and inventory carrying cost
- Strengthening of existing operational technology infrastructure
- Detection and protection of operational system from Cyber Security vulnerabilities
- Improvement in reliability of power supply to consumers.

4.7.4 Cost Benefit

- Implementing SCADA and centralize operation through PSCC lead to optimization of resources and cost to company.
- Currently all the substations are operated by the substation operators locally and there are 7 nos. of substation operators, operating each substation.

- For each substation 3 manpower can be optimized & redeployed which result in saving of INR 2.52 L/Substation per year.
- Due to improvement in reliability, unserved unit will be available for distribution. Based on last 4-month analysis in BCDD-I (which is contributing 2 % of total load) approximately unserved unit is nearly 2 MU/month i.e. 24 MU/Year.

4.8 Impact of Not Carrying out the Project

With the growth in the distribution area and unpredicted environmental changes due to cyclone, monitoring and maintaining the availability and reliability of electrical system may become very difficult in the absence of a centralized monitoring and Control Centre. In such a scenario coordination between stations would be very difficult and the absence of coordinated activity between various stations would lead deterioration of the quality of the service offered. Additional manpower will be required to control electrical network manually from respective Sub-stations. This will also affect fast restoration of power supply, fault analysis and fault isolation, real-time data exchange with enterprise system and other utilities.

To meet the business needs in most competitive and regulated market, in absence of real time visualization of electrical network centrally, it is difficult to take decision and initiate corrective actions to serve consumers clean and uninterrupted power supply efficiently at competitive cost.

It will be difficult to meet future load growth due to restricted capacity in the existing System

Due to ageing of the existing hardware and no OEM support for maintaining system, it is difficult to ensure availability and reliability of the SCADA System for remote monitoring and Control.

Obsolete operating system (Windows XP), No patch management and of Software upgradation in server and workstations, will lead to higher risk of cyber-attacks.

Due to multiple system and implementation agencies, maintenance of the system is not technically and commercially optimal, also requires maintenance of the separate inventory for all systems.

4.9 Communication Infrastructure

The backbone of the SCADA system is the communication infrastructure that interconnect various Sub-stations with the Centralized SCADA system. Currently the entire communication is established using services of the Network Bandwidth Service Provider (NBSP). Ensuring the availability and reliability of the communication network is one of the crucial factors for successful operation of the SCADA network. Ideally each of the Sub-station should be communicated or connected to MCC and APSCC through two independent parallel paths. Considering spread of distribution network, it is very difficult to build own communication infrastructure.

It is possible to build hybrid communication infrastructure for Automation WAN as available/applicable. The proposed system shall be capable of communicating to TPCODL sub-stations using 4G/RF communication (MPLS) network, Fiber Optic (OPGW/UG/ADSS) connectivity and LORA based Communication. Long-term plan of TPCODL is to have reliable fiber optic infrastructure to establish communication link between Sub-station and Control center by laying OPGW or U/G OFC, and establishing communication link between cities using OPTCL/PGCIL fiber optic network.

Accordingly, TPCODL will prepare the roadmap for a reliable and robust communication infrastructure independently and will be presented for approval to the Hon'ble OERC.

4.10 Cost estimate and CAPEX Requirement

4.10.1 CAPEX Plan

TPCODL has identified a number of challenges related to Safety, 33KV/11KV/0.415KV network, Automation infrastructure and Technology usage. These challenges are planned to be addressed through a systematic investment plan by TPCODL. The proposed "Capex Plan" represents a justified and efficient level of total capital investment estimated by TPCODL to meet the service obligation; improving safety, reliability of network and level of service standards. The summary of Capex requirement for three years (FY 2021 to 2024):

Table 4-4 : Capital Expenditure Requirement

Phases	Phase # 1	Phase # 2	Phase # 3	Total Cost with Taxes (GST 18%)
	FY 21-22	FY 22-23	FY 23-24	
Scope of Work	Deployment of New SCADA System to set up MCC and APSCCs	a. Deployment of New SCADA System to set up MCC & APSCCs b. RTU Installation, Commissioning & Testing of 90 Nos. of Conventional type substation for As-Is SCADA Monitoring	a. RTU Installation, Commissioning & Testing of 105 Nos. of Conventional type substation for As-Is SCADA Monitoring	
Breakup of Capital Expenditure (Rs Cr)				
SCADA	20	53	0	73
RTU (As-IS) For Conventional S/s	4	15	23	42
RTU for GSAS S/S	7	7	0	14
Total Cost	31	75	23	**129**

The approved Capital Expenditure for FY 2020-21 is Rs 4.71 Crores. The Scope of work under the 4 year programme i.e FY 2020-21 to FY 2023-24 is as follows:

Table 4-5:Scope of Work under SCADA implementation

Sl. No.	Phase	Stations	Total Number of Sub-Station Covered
1	**Approved Capex FY 21**	All SCADA enabled S/s under R-APDRP 21 nos. of ODSSP S/s	73
2	**Phase # 1** **FY 22**	Substation under ODSSP Substation under GSAS Refurbishment Conventional S/S for As-Is SCADA Monitoring	103
3	**Phase # 2** **FY 23**	Substation under ODSSP Substation under GSAS Refurbishment Conventional S/S for As-Is SCADA Monitoring	90
4	**Phase # 3** **FY 24**	Conventional Substation for As-Is SCADA Monitoring	105
5	**Total Nos. of Sub-Station Covered**		**371**

With reference to the overall approved budget under 3 year plan all 371 nos. of substations can be automated, comprising of all Urban, Semi Urban, Industrial and Rural S/s.

Table 4-6 : Substation covered in FY 21

Scheme	Operationalization of Substation through existing SCADA System
RAPDRP Scheme	52 Nos. Urban Sub Stations
ODSSP Scheme	21 Nos. Urban, Industrial, Semi urban, Rural Sub Stations
Total Sub-Station Covered	73 Nos.

Table 4-7 : Integration of Substation are considered in Phase-1

Scheme/Circle	Operationalization of Substation through existing SCADA System

Substation under ODSSP Substation under GSAS Refurbishment Conventional S/S for As-Is SCADA Monitoring	103 Nos. Urban, Industrial, Semi urban, Rural Sub Stations
Scheme/Circle	**Deployment of New SCADA System**
All 5 Circle	5 APSCC for each Circle
Total Sub-Station Covered	103 Nos.

Table 4-8 : Integration of Substation considered in Phase-2

Scheme/Circle	**Operationalization of Substation through New SCADA System**
Substation under ODSSP Substation under GSAS Refurbishment Conventional S/S for As-Is SCADA Monitoring	90 Nos. Urban, Industrial, Semi urban, Rural Sub Stations
Scheme/Circle	**Deployment of New SCADA System**
MCC & All 5 Circle	MCC and 5 APSCC for each Circle
Total Sub-Station Covered	90 Nos.

Table 4-9 : Integration Substation considered in Phase-3

Scheme/Circle	**Operationalization of Substation through New SCADA System**
RTU (As-IS) For Conventional S/s	105 Nos. of Conventional Substation for As-Is SCADA Monitoring
Scheme/Circle	**Support & Services of SCADA OEM**
MCC & All 5 Circle	MCC and 5 APSCC for each Circle
Total Sub-Station Covered	105 Nos.

Annexure-1: Proposed Architectures at MCC & APSCC

Figure 4-4 :Proposed Centralized SCADA/ADMS System at MCC and APSCC SCADA/ADMS at Bhubaneswar-I, Bhubaneswar-II, Cuttack, Dhenkanal and Paradeep

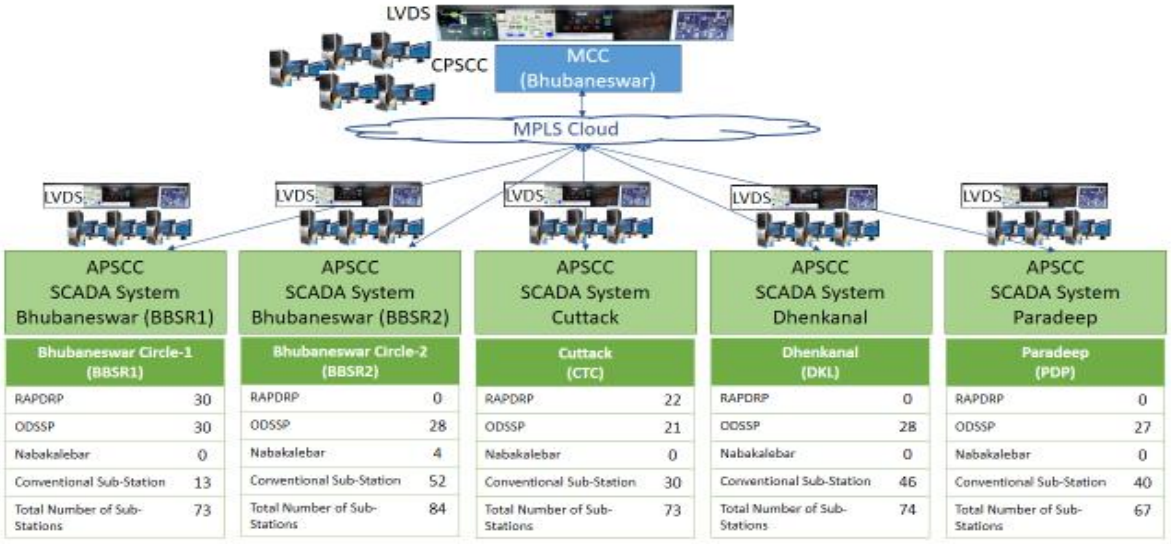


Figure 4-5 :Proposed Centralized SCADA/ADMS System at MCC

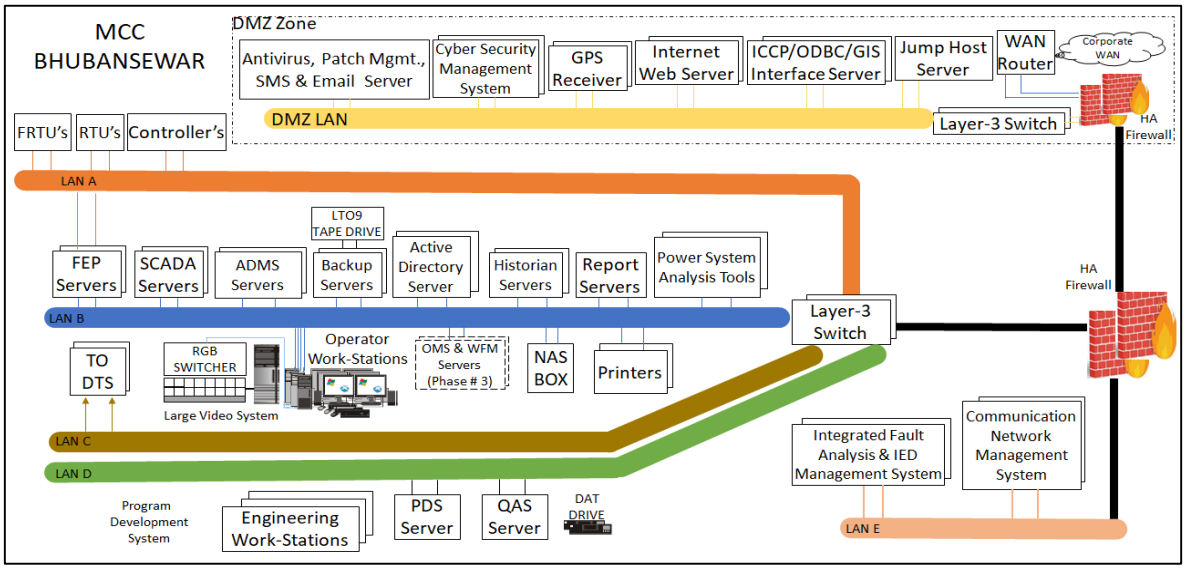


Figure 4-6: Proposed SCADA/ADMS System at APSCC

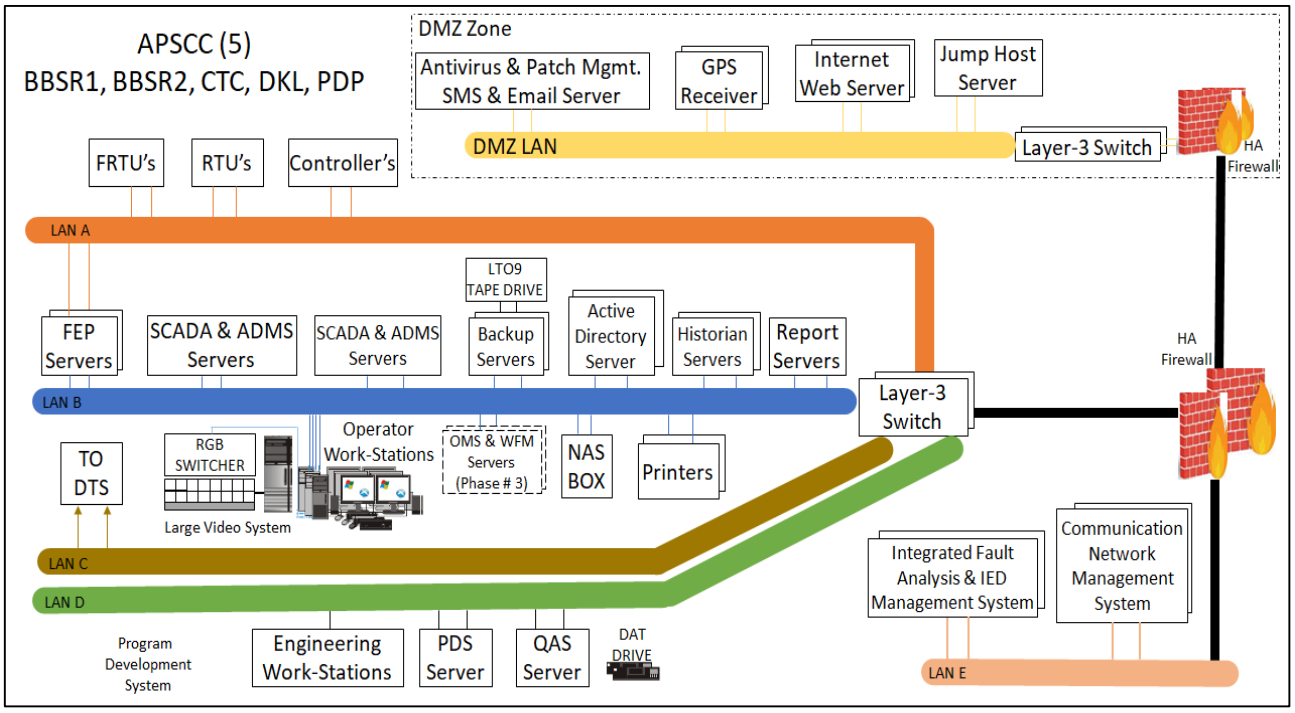
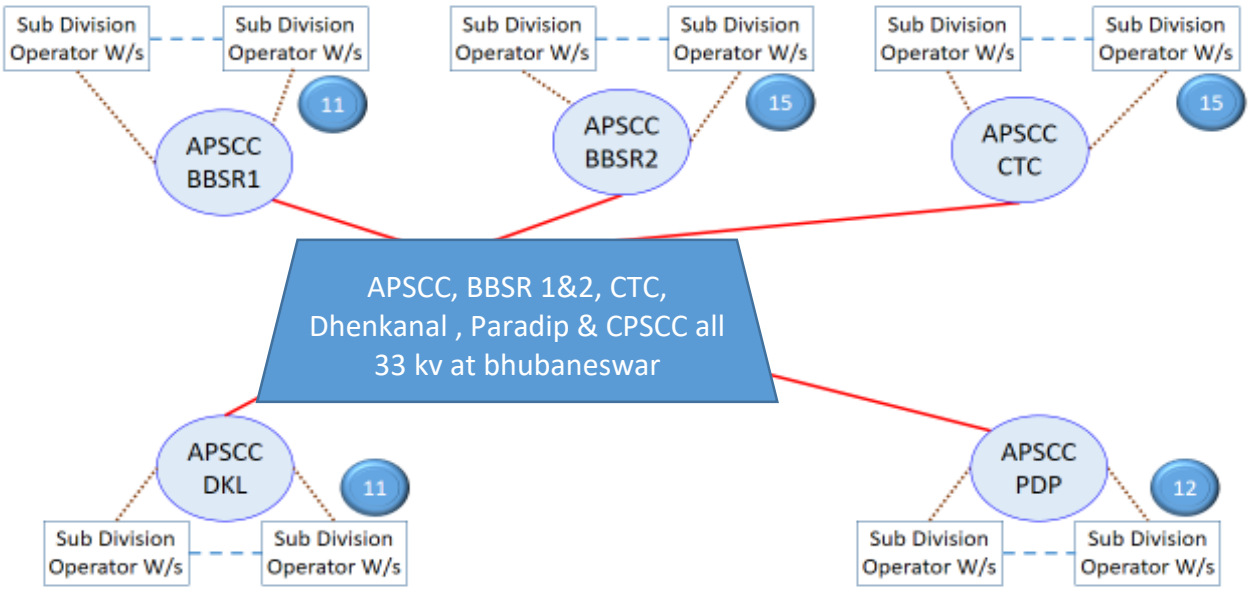


Figure 4-7 :Proposed Local Display Monitoring System (Operator Workstations) at all Circle Division (64 Divisions)



5 DPR for Augmentation of Communication Network in TPCODL Area

5.1 Introduction:

Tata Power Central Odisha Distribution Limited (TPCODL license area is spread over a geography of 29354 Sq.km and serves registered consumer base of 2.6 million covering 9 Revenue Districts of Odisha State, namely: Cuttack, Purl, Dhenkanal, Angul, Khurda, Kendrapara, Nayagarh, Jagatsinghpur and part of Jajpur.

TPCODL is in the process of developing an Integrated Communication System throughout its territory to support core business functions of IT, Operations, Commercial and Customer services. Study has been conducted to review present Communication infrastructure in operation at TPCODL and analysis done for various communication alternatives, including own or outsourced means such as Leased/own fiber optics, microwave media or Cellular technologies. DPR proposes ICT Strategy and Recommendations to meet immediate as well as long term requirements of TPCODL in order to meet target specific requirements of:

- AT&C loss reduction
- Reliability
- Load Growth
- Administration and Infrastructure

The Communication System is proposed to support following application:

Phase1:

- Enterprise Applications (mail)
- Commercial - ERP, CRM.
- Substation Automation & SCADA, GIS
- Call Center, Data Center and Stores

Phase 2:

- Distribution Automation , Outage Management system (OMS/ADMS)
- Tele-Protection
- Smart Metering
- Integrated Security Solutions
- Solar/ DER / EV

5.2 Communication Network: As-Is situation

As on date, In TPCODL there are approx. 377 nos. of office locations and Approx. 370 nos. of grid sub stations. Following are the connectivity details implemented through RAPDRP –Part A of SCADA and IT implementation.

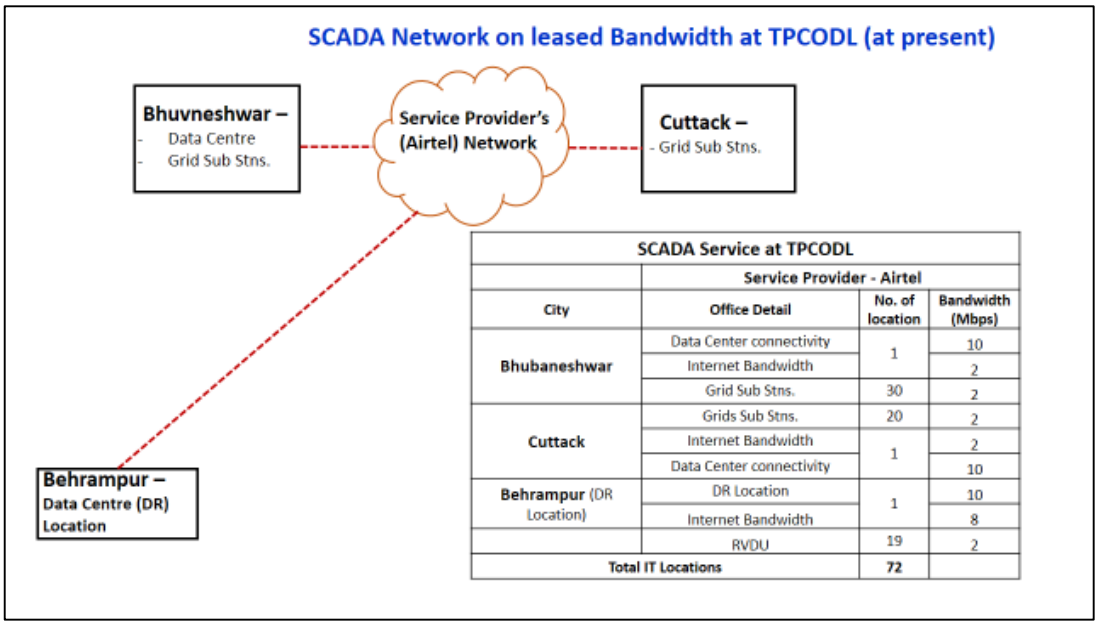
5.2.1 Under RAPDRP Part A – SCADA

M/s DFE has executed SCADA project in TPCODL and there is tripartite agreement between TPCODL, M/s DFE and M/s Airtel for communication establishment.

- 71 nos. of grids (30 at Cuttack and 41 at Bhubaneshwar) are connected through 2 Mbps MPLS links provided by M/s Airtel .
- There are separate control centers set up for SCADA at Bhubaneshwar and Cuttack which have 10 Mbps of MPLS VPN link and 2 Mbps of internet link.
- 448 No.s (242 in Cuttack and 206 in Bhubaneshwar) of FRTU/FPI are connected through GPRS .
- DFE has also installed DC routers at all RAPDRP grids.
- 5 grids at Puri town are connected through TPCODL owned OFC (24 F) approx... 25Km. and have separate control center. Project was executed by L&T/Schneider.

The schematic is as provided in the figure below

Figure 5-1: Schematic of existing SCADA Network



SCADA Service at TPCODL			
	Service Provider - Airtel		
City	Office Detail	No. of location	Bandwidth (Mbps)
Bhubaneshwar	Data Center connectivity	1	10
	Internet Bandwidth		2
	Grid Sub Stns.	30	2
Cuttack	Grids Sub Stns.	20	2
	Internet Bandwidth	1	2
	Data Center connectivity		10
Behrampur (DR Location)	DR Location	1	10
	Internet Bandwidth		8
	RVDU	19	2
Total IT Locations		72	

5.2.2 Under RAPDRP PART A – IT

M/s L&T has executed RAPDRP –IT project in TPCODL with M/s Vodafone as Primary Service provider and M/s Airtel as secondary service provider for communication establishment. LOA has been awarded in 2018 for 5 years validity with appropriate termination clause.

- 68 nos. of offices (45 at Bhubaneshwar and 23 at Cuttack) are connected through 2 Mbps of MPLS link to DC
- DC set up at Bhubaneshwar with 8 Mbps of MPLS link and 10 Mbps of internet link.
- Customer Call Center at Corpoarte office is connected through 4 Mbps of MPLS VPN link.
- 20 Mbps of DC-DR replication link established.
- Approx. 9200 nos. of DT/HT meters connected through GPRS for energy metering.

Summary of the Communication Infrastructure deployed at TPCODL is as below:

Table 5-1: Present Communication Infrastructure

		Primary Service Provider - Vodafone		Secondary Service Provider – Airtel	
City	Office Detail	No. of location	Bandwidth (Mbps)	No. of location	Bandwidth (Mbps)
Bhubaneswar	Data Center connectivity		8		4
	Internet Bandwidth	1	10	1	4
	DC- DR replication link		20		10
	Customer care	1	4	1	4
	Circle offices	1	2	1	2
	Divisions	3	2	3	2
	Subdivision offices	8	4	8	4
	Sections	37	2		
	Internet Bandwidth for Scada	1	10		
	Grid Sub stations	30	2		
Cuttack	Circle offices	1	2	1	2
	Divisions	2	2	2	2
	Sub Division	7	4	7	4
	Sections	16	2		
	Internet Bandwidth for Scada	1	2		
	Grid Sub stations	22	2		
Berhampur (DR Location)	DR Location	1	8	1	2
	Internet Bandwidth		8		4
	RVDU	19	0		
Puri	Control Center for scada	1			
	Grid Sub stations	5	10		
Total IT Locations		**157**		**18**	

The services of communication deployed is not effective and need upgradation depending upon the requirements for reliable communication as communication is backbone for effective implementation of technology and providing better services to the services.

5.3 Requirements:

Communication requirement is to support core corporate functions in (a) system operations, protection, maintenance and outage recovery, (b) customer service, accounting and billing,

(c) workforce development and training. The introduction of latest communications infrastructure will enable utility to capture corporate goals, achieve organizational effectiveness and process innovation. Such initiatives have witnessed a turnaround for effectiveness, efficiency and commitment to aspire for excellence journey.

There no connectivity provisioned at rest of the offices however, on piecemeal basis, Broadband/4G Dongle is available with monthly plans to some extent but this is not sufficient for connecting offices in effective way. To provide better services to the consumer, it is required to have robust communication network in offices so that efficient services to consumer can be provided using various technology intervention. In view of this, it is required to extend communication of enterprise services to the following locations:

Locations identified for extending Enterprise services are as follows:

Table 5-2: Locations identified for extending services

Location	No
Circle Offices	5
Divisional Offices	20
Sub divisional Offices	65
Section offices and Commercial Offices	247
Total	**337**

Table 5-3 :Break up of Locations:

S.No.	Town	Area in Sq. Km	Consumer base	No. of Grid S/stns.	No. of offices locations	
1	Cuttack	64	151550	22	34	(CO-01,DO-02,SDO-07,SEC-24)
3	Puri	30	50000	6	13	(DO-01,SDO-03,SEC-08,SCADA CONTROL ROOM-01)
4	Dhenkanal	30.56	14878	3	5	(CO-01,DO-01,SDO-01,SEC-02)
5	Angul	19.8	19600	1	4	(DO-01, SDO-01, SEC-03(no1,no2,no3))
6	Khurda	25.64	11500	1	6	(DO-01,SDO-01,SEC-04)
7	Kendrapara	10.77	13950	1	7	(DO- 01 No, SDO- 01, SDO- 03, MRT Office- 01, Energy Police Station-01)
8	Nayagarh	15.54	9500	1	4	DO-01, SDO-01,SEC-02)
9	Jagatsinghpur	20	8000	2	4	(DO-01,SDO-01,SEC-02)
10	Bhubaneswar	135	360491	22	48	(CO-02,DO-03,SDO-08,SEC-35)

5.4 Communication architecture Criteria and Options:

5.4.1 Communication Infra/technologies for consideration

- **Media:** U/G, O/H Fiber/ Lease Line B.W /Telecom Service Provider (TSP) /Microwave.
- **Technologies**: VPN IP-MPLS B.W/ P2P Lease Links/ Public LTE network /L3 switching/Wireless WAN.
- **Security:** NGE (network group encryption).
- **iNMS**: Integration of all active components for Centralized monitoring.

5.4.2 Design criteria for critical-communication networks

- **Flexibility:** Enables and adapts to new application
- **Scalability:** Handles increased bandwidth demands in efficient and cost effective way
- **Predictability:** Manages and enforces service quality controls, provide high resiliency
- **Security:** Protect the network with security-by-design, and encryption
- **Simplicity:** Management tools that use industry speaks to accelerate technology adoption and reduce TCO
- **Resiliency:** Designed for no single point of failure at the network nodal level; multi-failure recovery
- **CAPEX/OPEX:** Consideration of upfront cost required for Communication network set-up and specific to support particular applications as well as availability/presence of other service providers
- **Short Term/Long term:** Communication infra requirement as per the Business requirements (immediate & future) as well as Technology roadmap of TPCODL considering Bandwidth, Latecy, scalability etc.
- **Circle/State Level:** Communication requirement specific to a particular Circle considering geographic and demographic conditions as well consider building a umbrella communication network across TPCODL

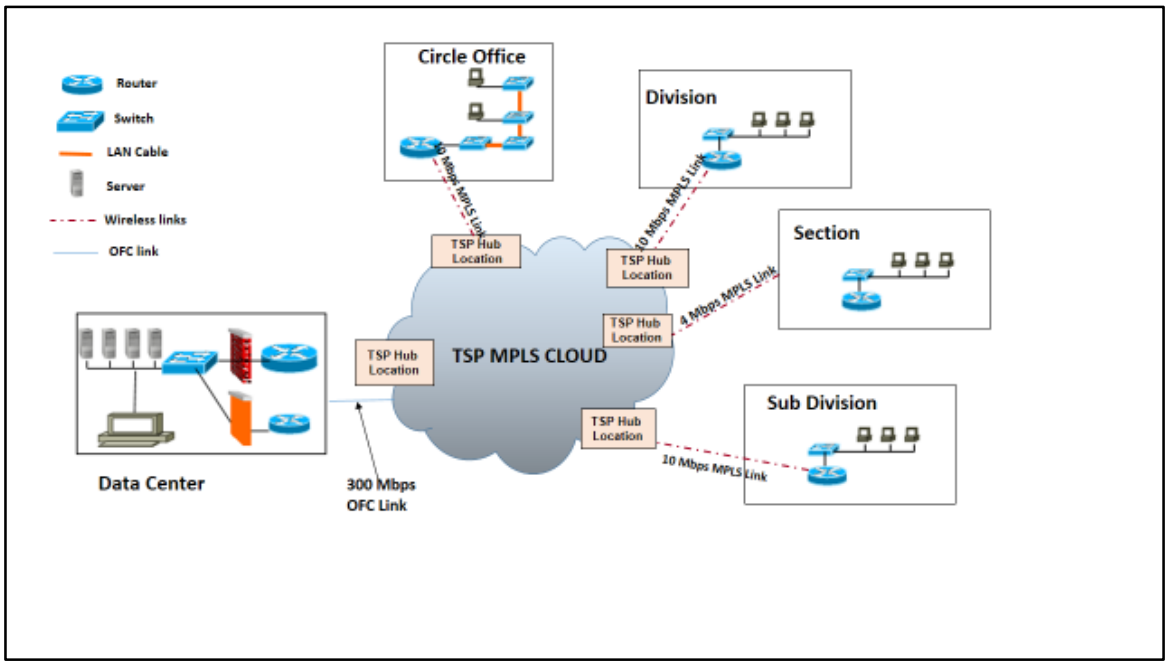
Following factors were considered while evaluating Communication technology to be implemented at TPCODL.

- Existing Communication Infra
- Consumer base and spread
- TPCODL locations and spread
- Feasibility of creating Utility own infrastructure
- Presence of Telecom Service Providers
- Environmental Condition
- Bandwidth requirements

5.4.3 Option 1: MPLS links from TSP

Communication network is planned to be deployed for main locations as main hub and services like E-mail, Video Conferencing, On Line Billing, and Web Services ERP can run effectively. It would be feasible to connect these location through MPLS links leased through Telecom service provider (TSP). Proposed technical solution is as follows:

Figure 5-2 :Proposed linking of Network (Phase 1 Architecture)



Architecture would be full Mesh where DC location would be provisioned as Central location and all other locations will be communicating to/ through DC. All TSP circuits would be terminated on TSP provided device (CPE) at Data Center. All new locations can be part of this cloud and integrated in fully mesh for 100% reliability.

Advantage:

- Most feasible, simple and easy to implement and maintain.
- Highly reliable as it run over IP/MPLS in full mesh

Disadvantage:

- In long term solution is not viable from Cost perspective.
- Depedency on 3rd party Service provider network. For ensuring reliability, TPCODL may end-up replicating through other service providers , doubling the cost
- Uncertaininty of business continuity with TSP as observeed from Delhi/Mumbai business. Capacity issues faced at TSP's last mile node risking no communication network availability
- No committed SLA's by TSP for mobility services

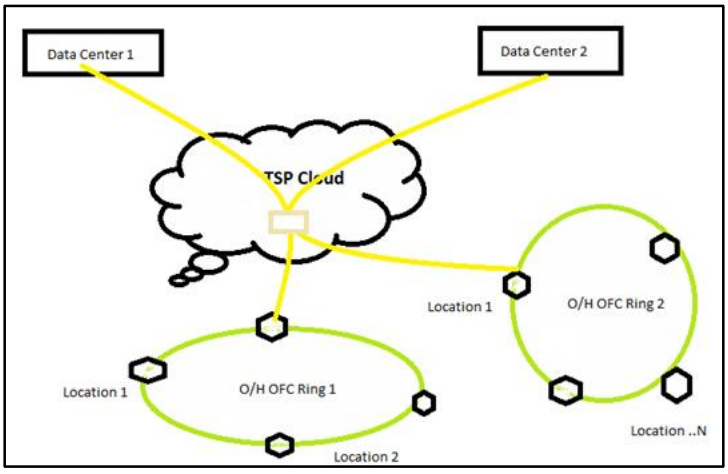
Note:

We can reduce the cost considerably by taking Point to Point Leased Links from Broadband service providers and using MPLS VPN links from TSP only for connecting aggregator nodes.

5.4.4 Option 2: Point to point connectivity through O/H OFC

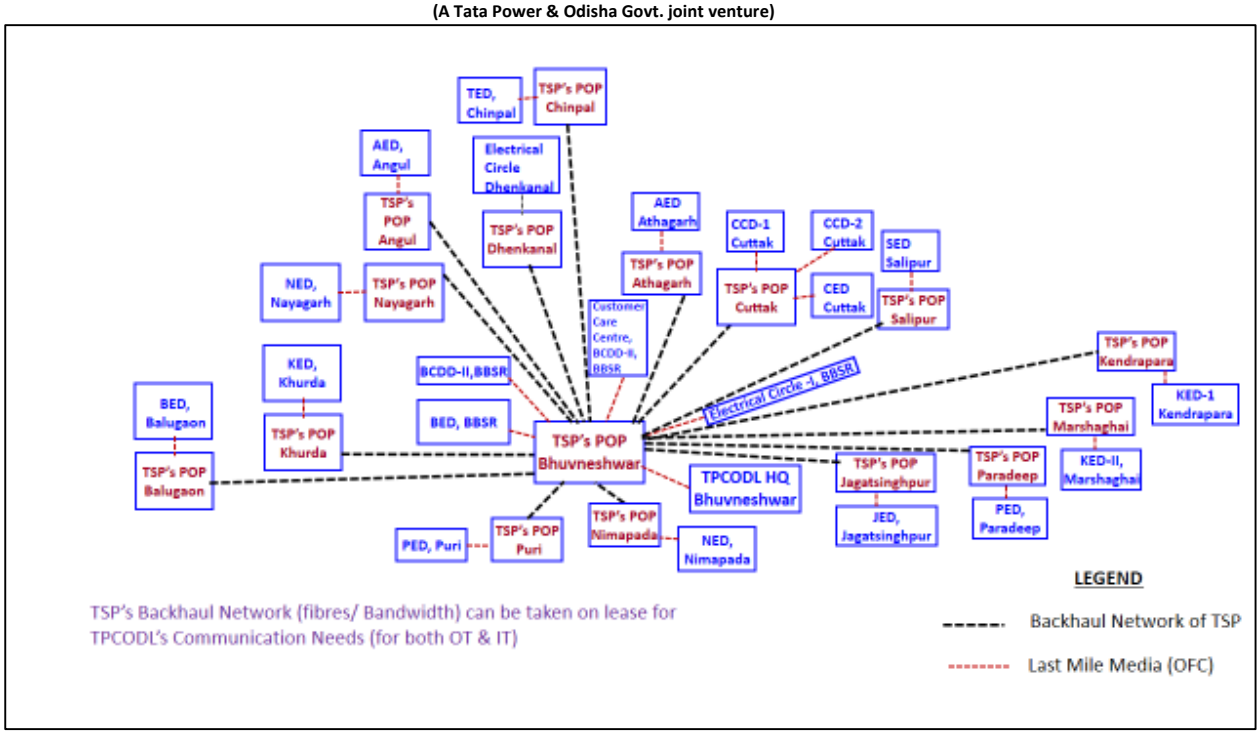
Laying of U/G OFC is a challenge due to underground rocks. Another option is to identify **clusters** of Offices, Grid sub-stations which are in close vicinity. Connect these clusters through O/H OFC over electricity poles. Installing L3 switches at these locations to run multiple services. Backup to the cluster can be provided by MPLS VPN link from TSP.

Figure 5-3: Point to Point Connectivity through O/H OFC- I



Green line indicates Utility owned O/H OFC network laid over electrical poles. Yellow lines are the leased MPLS links for backhauling of OFC aggregation node.

Figure 5-4: Point to Point Connectivity through O/H OFC- II



Advantage:

- Most feasible, simple and easy to implement
- Cost effective solution (very less recurring cost)
- Future ready, Utility owned infrastructure

Disadvantages:

- Need dedicated team to maintain the network
- Initial cost of building network is comparatively high (please refer table …for cost calculations)

Remarks:

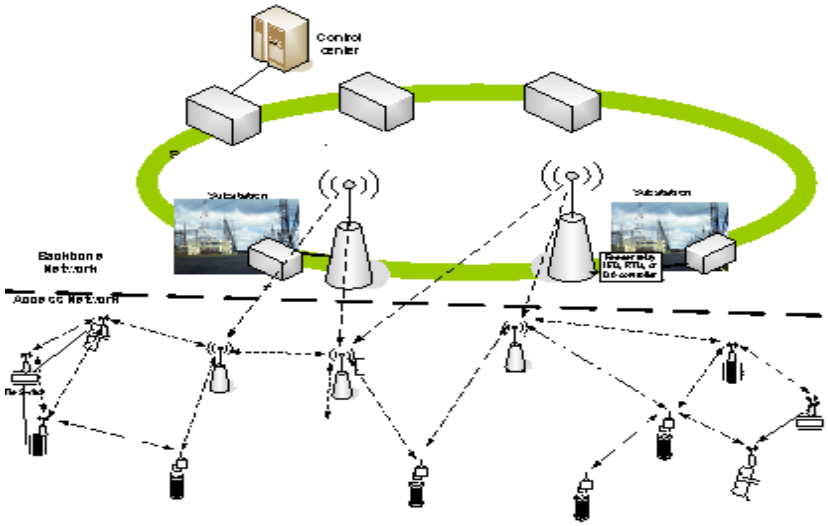
Considering geographical and demographic conditions this option seems to be most feasible in TPCODL (except for coastal areas).

5.4.5 Option 3: Point to Multi Point Microwave links between the locations.

A wireless Point-to-multipoint access point could be established at the grid substation to capture all field devices including distribution substations and TPCODL remote end offices within range (based upon site survey and link feasibility network design can be finalized). These microwave links operate in in-licensed band (2.4/5.8GHz). The radios are long range radios and designed to withstand high speed wind. The microwave links ranging 10 Mbps – 270 Mbps can be installed based on requirement. Backhauling of Hub location to Data Center

can be extended through IP/MPLS VPN link from Telecom Service provider. All Hub locations will be connected in full mesh using TSP's cloud. Network Architecture is as below:

Figure 5-5: Multipoint Microwave Link



Advantages:

- This is a cost effective, utility owned solution for last mile connectivity
- Can be deployed in far-off areas where there is no other communication available and less prone to High-winds like Talcher, Angol and Dhenkanal etc.

Disadvantage:

Suitability needs to be tested under field conditions; may not be suitable for coastal areas like Puri, Paradip, Bhubneswar and Cuttak.

5.5 Recommended Communication architecture:

Based on option available, it is recommended to have a solution from Option 1 & option 2. In totality, the proposed Communication network can be created with 3 types of category as mentioned below:

1. **Category 1:** Connectivity between Circle offices

   This can be achieved by:

   - Taking leased OFC/OPGW pair or bandwidth from TSP's, thus forming ring
   - MPLS VPN links from TSP's terminating from Circle office (aggregator node) to Data Center, in full mesh architecture

2. **Category2 : Within Circles**

- Deploying MPLS VPN links directly from site to DC, in full mesh architecture (157 sites already connected through MPLS VPN links with 2 Mbps capacity against required capacity of 10 Mbps. However this is not a cost effective solution.

- Connect clusters of Offices, Grid sub-stations which are in close vicinity through Point to Point Leased Links or laying O/H OFC over electricity poles. Backhaul to the Circle office (aggregator node) through MPLS VPN links from TSP

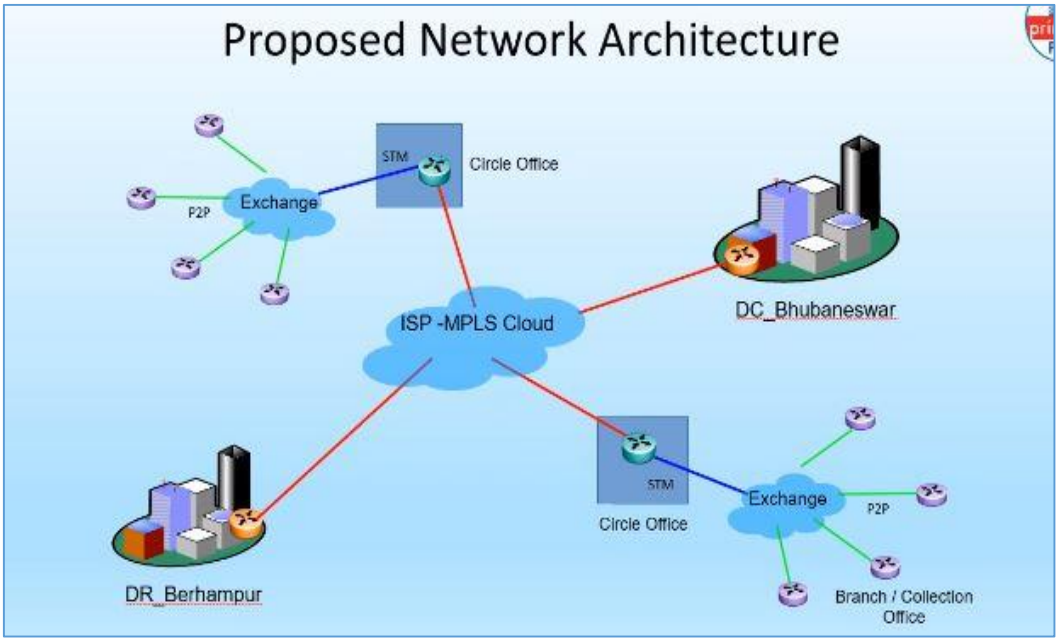
- Point to Multi Point Microwave links between the locations for far-off locations in specific areas. Backhaul to the aggregator node through MPLS VPN links from TSP (excluding Bhubaneswar) and till the time OFC network is not laid. For Bhubaneswar, it is proposed to start building network using O/H OFC only.

- In long term, TPCODL shall make a practice to lay U/G OFC along with Power cables for having connectivity with Sub Stations/ Offices.

3. **Category 3: Within Locations**

For Division/Sub-divisions; P2P Links from Broadband service providers or O/H OFC links will terminate at IP-MPLS switching equipment / L3 switches to form Access rings. L2 switches will be used for service distribution to local users.

Figure 5-6: Network Infrasrtructure



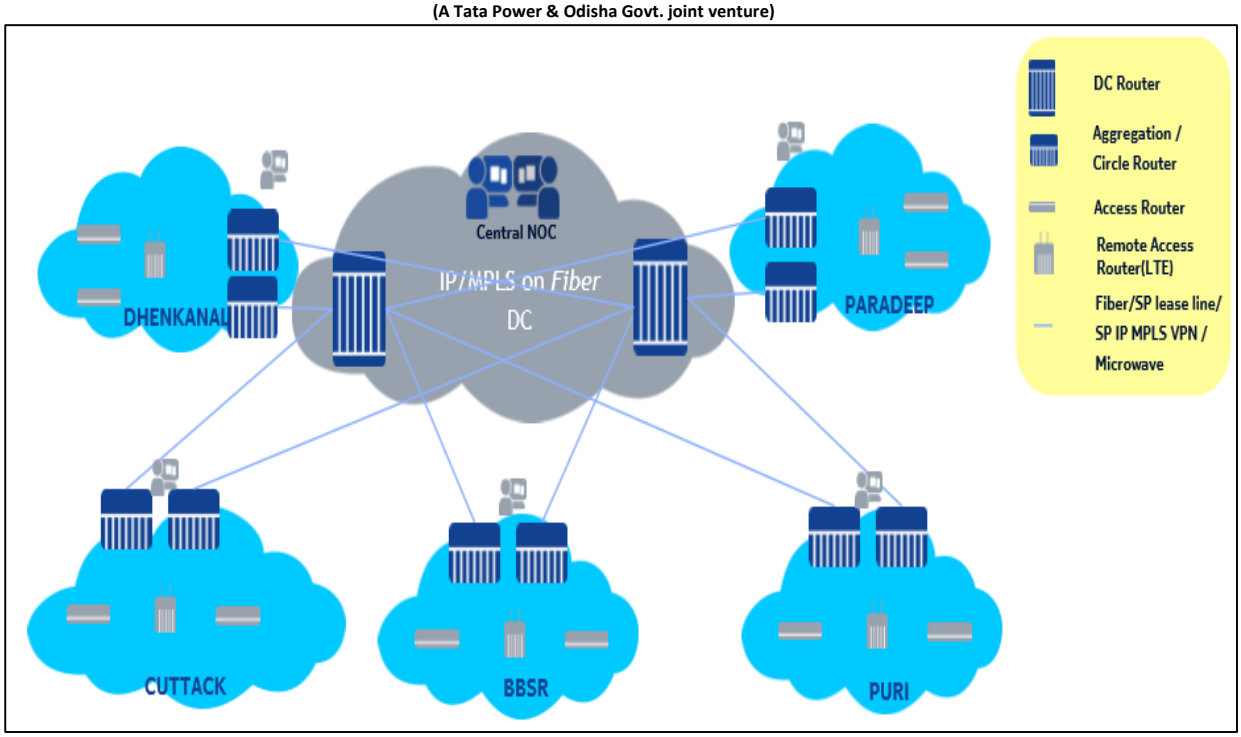
Source: Print link CC Orissa

- All Circle offices would be connected through MPLS Network across the Districts (Khurda, Cuttack, Puri, Paradip & Dhenkanal) of Odisha.
- DC at Bhubaneswar & DR at Berhampur (temporary) would be connected through MPLS Network.
- All Branch / Collection Offices would be connected through Point-to-Point Lease Line /OFC Network.
- **Security:** NGE (network group encryption) encryption solution that enables end-to-end encryption of MPLS services, Layer 3 user traffic, and IP/MPLS control traffic for maximum availability and uncompromising security and protection of any traffic in the mission critical IP/MPLS/carrier leased line as well as wireless network (4G, LTE) network.
- **iNMS**: Integration of all active components for Centralized monitoring

A. Connectivity at Equipment level:

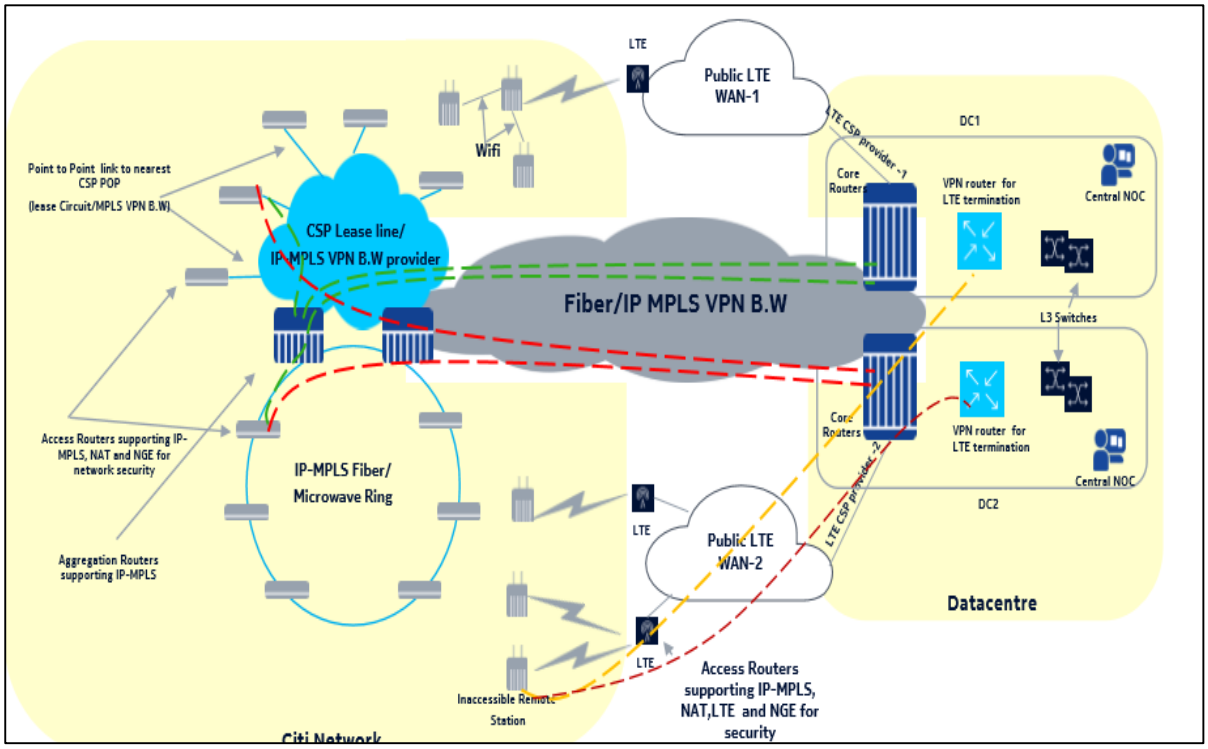
Ethernet routers supporting services like SCADA, L2 (Ethernet) / L3 (enterprises), IP-MPLS VPN, Multicast etc. will be connected on 1Gbps Ethernet ports in a ring or to communication service provider on VPN bandwidth as per feasibility and availability of media which can be Fiber/copper or radio links. All router traffic will be terminated to Aggregation Routers at circles.

Figure 5-7: Equipment Connectivity



Source: Nokia

Figure 5-8: Connectivity across division



Source: Nokia

Ethernet routers supporting services like SCADA, L2 (Ethernet) / L3 (enterprises), IP-MPLS VPN, Multicast etc. will be connected on 1Gbps Ethernet ports in a ring or to communication service provider on VPN bandwidth as per feasibility and availability of media which can be Fiber/copper or radio links. All router traffic will be terminated to Aggregation Routers at circles.

Aggregation router will have Access router terminated on 1G ring (fiber, copper or Radio) or CSP will provided aggregate throughput on 1G or10G ports. Aggregation router will be connected to central core routers on 1G or 10Gbps uplink based on bandwidth requirement and CSP feasibility DC Core & VPN Router.

Remote locations can be connected through 4G LTE using Wireless WAN with last mile connectivity at DC firewall.

5.5.1 Budget Requirement:

Cost estimation for MPLS & Point-To-Point circuits will differs with available service providers in different circles across TPCODL.

For cost calculation, we have made following assumptions:

1. Distance between offices approx. 2 -10 KM (average distance in Bhubneswar & Cuttak is 4 Km); Bandwidth allocated to (Circle, Division & Sub Divison -10 Mbps, section offices – 4 Mbps) and aggregated bandwidth at aggregator is 50 Mbps; Circle office to data center 100 Mbps
2. 300 MBps MPLS VPN link between Data Centers (2 nos.)

The break up and phasing of the Capital Expenditure is as given below

Table 5-4 : Breakup of the Capital Expenditure

MPLS VPN Leased links from TSP and Aerial OFC through Poles														
S.No.	Link Details	Bandwidth (Mbps)	No. of Link	Unit Rate (OTC)	Uniot rate (ARC)	Year 1		Year 2			Year 3			
						60	60	150	150	60	127	127	210	
						CAPEX (Rs. In Lacs)	OPEX (Rs. In Lacs)	CAPEX (Rs. In Lacs)	OPEX (Rs. In Lacs)	OPEX (P) (Rs. In Lacs)	CAPEX (Rs. In Lacs)	OPEX (Rs. In Lacs)	OPEX (P) (Rs. In Lacs)	
Connectivity of Data Center & Circle Offices (Through IP/MPLS Link)														
1	IP/MPLS Leased Link between DC & DR	300	2 (Primary + Backup)	1.2	14	2.4	28			28			28	
2	IP/MPLS Leased Links from Circle office (5 Nos.) with Data Center (DC+DR)	100	2 (Primary + Backup)	0.8	6	8	60			60			60	
3	IP/MPLS equipment at Data Center with redundancy	NA	NA	15		60								
4	IP/MPLS equipment at circle office	NA	NA	10		100								
	Sub Total					170.4	88			88			88	
Connectivity of Data Center & Circle Offices (Through IP/MPLS Link)						Year 1 (60 locations)		Year 2 (150 locations)			Year 3 (127 locations)			
5	IP/MPLS Leased Links from Aggregator site node to Circle office (Aggregator site is node which further connects 15 location)	50	1	0.5	3.2	2	12.8	5	32	12.8	4.2	27.1	44.8	
6	Optical connectivity for locations (Division/sub-Divison/ Section offices) (Average 4km O/H OFC for each location from node @ 2 L/Km)	4	1	8	0.8	480	48	1200	120	48	1016	101.6	168	
8	IP/MPLS equipment at Aggregator site			6		24		60			50.8			
7	L3 Switch/Router at Locations (Division/sub-Divison/ Section offices)			3		180		450			381			
9	Misc./ Sevice items per Location			0.5		30		75			63.5			
	Sub Total					716.00	60.80	1790.00	152.00	60.80	1515.53	128.69	212.80	
Total Cost for One year						886.4	148.8	1790.0	152.0	148.8	1515.5	128.7	300.8	
Contigency (18%)						159.6	26.8	322.2	27.4	26.8	272.8	23.2	54.1	
Grand Total						1046.0	175.6	2112.2	179.4	175.6	1788.3	151.9	354.9	
Description						Year 1		Year 2			Year 3			
Year Wise CAPEX						1046.0		2112.2			1788.3			
Year Wise OPEX						175.6		354.9			506.8			
Total CAPEX Cost for 3 year for 2 Data Centers, 5 Circle and 337 locations						4946.5								
Total OPEX Cost for 3 year for 2 Data Centers, 5 Circle and 337 locations						1037.3								

5.5.2 Implementation Plan:

Period of commissioning is **3** year from date of approval.

In first phase (Year1) , Communication connectivity will be provisioned for 60 nos. of locations to connect primarily Circles offices, Division Offices, Sub-Division, Section offices and Data Centers) primarily to meet the enterprise and business requirements.

In second phase (Year 2), Communication connectivity will be provisioned to connect primarily Sub-Division , Section offices) primarily to meet the enterprise and business requirements. (150 locations)

In third phase (Year 3): Communication network is to be deployed for balance 127 nos. of locations.

5.5.3 Abbreviations:

CPE: Customer Premises Equipment
TSP: Telecom Service Provider
iNMS: Integrated Network Management System
STM: Synchronous Transmission Module
SD-WAN: Software Define WAN
NEG: Network group encryption
O/H OFC: Overhead OFC
OPGW: Optical Ground Wire

FRTU: Field-RTU

FPI: Fault Passage Indicator

MPLS: Multi-protocol Label Switching

LTE: Long Term evolution – Cellular

OTC- One Time Cost

ARC- Annual Recurring Charges

6 Description of Capital Expenditure Schemes other than DPR Schemes

6.1 Safety and Statutory

6.1.1 Safety PPEs & Equipment

Scheme Proposed	It is proposed to implement Tata Safety & Health Management System (TSHMS) at TPCODL to prevent work-related injuries & ill-health to the workers and to provide a safe & healthy workplace to the employees.
Capex Amount	Rs 5.5 Crs
Benefit to customer	The implementation of TSHMS will also help in improving the safety of all stakeholders (consumers, Business Associate employees & general public).

The detailed expenditure is as under:

Expenses for procurement of Personal Protective Equipment (PPEs) :

PPEs will be required to be provided to the workforce for the safe execution of work. PPE such as Safety Shoes, Safety Helmet, Full body safety harness, safety visor, polka-dotted hand gloves, rubber hand gloves, safety goggle, and reflective jacket will be provided to each employee. Many of the linemen are required to work in the paddy field or waterlogged areas so it is proposed to issue gumboots to the workmen to carry out the work safely in such hazardous areas. Existing substation operators are also not equipped with the arc flash suit. They are prone to a very high risk of arc flash of the breakers in the 33/11KV substations. It is proposed to provide one arc flash suit to each of the substations so that operators will perform the breaker operations safely. In the past, many of the incidents have taken place on the LT networks & linemen received burn injuries on the face. To prevent facial burn injuries, it is proposed to provide face visors to linemen while working on LT fuse call complaints to protect the arc flash on the face.

Expenses for procurement of Safety Equipment:

a) It is proposed to bring the technological interventions in the safety to reduce the risk of fall from height while carrying out the work on the poles of trimming the trees. It is proposed to procure the 5 nos of the man lifters to carry out the height work. The man lifter will be provided to each of the circles of TPCODL.

b) **Lock out-locks:** It is proposed to use the unique locks on the isolating points while issuing the line clearance permits so that safety of the working personnel will be ensured. Such LOTO locks will be provided to the lineman & substation operators to lock the isolating points to avoid the inadvertent charging of the feeders/lines.

c) **Neon Tester & Discharge Rod:** It is proposed to provide the set of neon tester & discharge rod with the each fuse call camp & sections so that the linemen can easily carry it at the working site to carry out the testing & discharging of the high voltage lines.

d) **FRP ladders** will be required to be given to each fuse call camp, substations & section offices to carry out the maintenance work on the poles. Fibre glass ladders of 9 meters & 12 meters will be provided to access the height so that workmen will not required to climb without following safety norms.

e) **Porta cabin:** TPCODL has already established practice yards to provide the practical trainings to the employees. It is proposed to procure the porta cabins which will be installed in the practice yard so that theoretical trainings will be also imparted at practice yard. These porta cabins will have the seating arrangement for the employees. In the first phase, it is proposed to procure 5 nos of porta cabins & these will be installed at 5 different practice yard of each of the circles.

f) **Tool kit:** It is proposed to provide the standard too bag with set of insulated tools for the linemen so that linemen will perform the all electrical activities in safety manner. These insulated tools will be tested for 1.1KV.

6.1.1.1 Provision of Safety Equipment, PPEs to workforce and training.

Personal protective equipment, or PPE, protects its user against any physical harm or hazards that the workplace environment may present. It is important because it exists as a preventative measure for industries that are known to be more hazardous, like manufacturing, mining and Electricity Distribution. It is important that PPEs and safety equipment provided to staff to carryout construction and maintenance activities should meet safety regulations and guidelines. Availability of correct type and size of PPE's for different activities ensures safety of workforce against injuries, incidents and accidents. Reduction in injuries, incidents and accidents helps to improve the productivity.

Any power distribution utility is bound to comply with all statutory requirements. Non-compliance results in enforcement action, penalties, harassment and loss of brand image. In

view of above, below mentioned PPE need to be procured for Metering Team for carrying out activities in safe manner.

Training of Employees and field staff is utmost important as it enables employees to work with safety and thus learn best practices. To train employees, provision for training and basic facilities required for training is covered in the given head.

State of Odisha being a coastal state is one of the most vegetative states of our country. This leads to growth of heavy vegetation. Tree branches usually grow fast and come in close proximity with our electrical lines, which may cause electrocution and lead to severe conditions, causing harm to general public and stray animals. To prevent this, we carry out patrolling as a part of our feeder maintenance activities and schedule branch cutting activities for parts of the tree which enters beyond the given electrical clearance limits. To carry out smooth and faster tree cutting, we have proposed for tree pruning machines along with additional blades.

Table 6-1: Capex for Safety PPE and Equipment

CAPEX EXPENDITURE FOR SAFETY -FY22					
Sr	**Safety PPE & Equipment**	**EOM**	**Quantity**	**Unit Rate**	**Amount in INR**
1	Arc flash suit	EA	325	55000	17875000
2	Ariel Tower Wagon	EA	3	3150000	9450000
3	LOTO- Locks	EA	5000	375	1875000
4	Neon Tester	EA	200	20355	4071000
5	Discharge rod	EA	200	18400	3680000
6	FRP ladder 3Fold 9M	EA	200	12400	2480000
7	FRP ladder 2 Fold 12 M	EA	200	16400	3280000
8	Porta cabin for training	EA	5	425000	2125000
9	Barricade Tape(250 meter) Bundle	EA	5000	700	3500000
10	Traffic Cone	EA	1000	500	500000
11	Lineman tool kit with Canvas bag	EA	300	7000	2100000
12	Projector	EA	5	15000	75000
13	First Aid box	EA	1000	650	650000
14	First Aid Chart	EA	500	250	125000
15	Rescue Kit for transmission lines	EA	20	55000	1100000
16	Manikin for CPR training	EA	5	16000	80000
17	Tree Pruner with Additional Cutter /Blade	100	100	20000	2000000
	Total Amount in Rs.				**54966000**
	Total Capex requirement in Rs Crore				**5.50**

6.1.2 Installation / Construction of Plinth fencing or Boundary wall of DSS or GSS and area development wherever required

Brief about the Scheme Proposed	At many of the places it was found that the condition of the Boundary wall of DSS/GSS was in a very dilapidated condition. Distribution Substation are located at various locations catering the power supply requirement to the consumers. Since these are installed at various scattered locations along the Road, public places, near the commercial areas etc. During the survey, it is observed that boundary walls or fencing are either damaged or not exists thus posing safety threat to stray animal and public at large. Ensuring safety of People & equipment is very much needed for safe operation. Hence it is proposed for Construction of Plinth fencing / FRP Fencing and Boundary wall for the DSS / GSS wherever required. *Fencing of Substation and Stores*- At many of the places it is found that the condition of the Boundary wall of DSS is in a very dilapidated condition. Ensuring safety of People & equipment is very much needed for safe operation. Hence it is proposed for Construction of Plinth fencing / Boundary wall of DSS / GSS wherever required. *Surrounding area and infrastructure Up-liftment*-Recently roads department have been raising the height of the road. This has converted our office premises as low lying area, there by adding to water accumulation upto 1.0 mtr. During rainy season it is very difficult to reach the structure for operations. Hence it is proposed to uplift the area around the structures/section offices and associated infrastructure.
Capex Amount	Rs.7 Crs
Benefit to customer	Improving the safety of people & stray animal Improving safety of the equipment

Table 6-2: Surrounding Area Upliftment/Development

Major Category	Activity	Amt (Rs Cr)
Safety and Statutory	Plinth fencing of S/S	0.5
	Construction of Compound Wall (0.0015 Lakh X 1000 RM)	1.5
	Area development (5 no X 0.50 Cr)	2.5
	Total	**4.5**

Table 6-3: Bill of Quantity (BOQ) for Construction of Boundary Wall Fencing and Fiber Reinforced Fencing:

Sr No.	Fencing Type	DSS Area	Height	Locations in No's	Unit	Amount per DSS	Total Amount incl. tax
1	Fly Ash BRICK with plastering	5M X 4M	1.2M	100	No	102000	10200000
2	FRP Fencing	5M X4M	2M	180	No	84000	15120000
Total Fencing				280		186000	25320000
						Rs Cr	2.532

6.1.3 Establishment of Meter Testing Lab with testing Equipment:

At present, there are 5 labs in TPCODL where 7 meter test bench are installed for testing of Single Phase and Three Phase meters. However these test benches are in dilapidated condition. To ensure high quality in bulk supply of meters, TPCODL has estimated that meter testing lab has to be developed in every Circle in next three years. These labs will ensure the statutory requirement of meter testing across pan TPCODL. Three years plan for developing three labs is given below, however in current DPR, CAPEX for activities in year one has been taken. Similarly requirement of testing equipment for LT & HT meters is given below

6.1.3.1 Need for Establishment of Meter Testing Lab

To ensure high quality in bulk supply of meters, TPCODL has estimated that meter testing lab has to be developed in every Circle. These labs will ensure the statutory requirement of meter testing in pan TPCODL.

As per the clause no. 102 (d) of OERC Supply code "*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*".

Below mentioned testing equipment are required to be procured in addition to facilities already available.

One Meter Testing Lab has been envisaged in 03 circles each (Bhubaneswar -1, Bhubaneswar-2 and Cuttack) in 03 years to handle large volume of meters deployment with quality. However this year, i.e FY 2021-22, only procurement of 20 No of Standard Meter bench (one per division) have been proposed to enhance the testing capability of Single Phase Meters

6.1.3.2 Test Equipment for meter testing in field

This capex arises to ensure the statutory guidelines of testing of meters in field and to address the meter testing on consumer request against fast/slow meter.

As per the guideline of OERC supply code, Clause No. 111(iii*) "The licensee/supplier shall also conduct periodical inspection/testing of the meters at site as per the following schedule or earlier":*

…..
(a) Single phase meters at least once every five years
(b) LT three phase meters at least once every three years
(c) HT/EHT meters including MDI at least once a year

Below mentioned testing equipment are required to be procured.

Table6-4: Meter Testing Facilities

Material	Unit Rate (W/o Tax)	Rate with Tax	Qty (in Nos)	Cost (in Cr)
Single Phase standard meters or testing meters in field	90000	106200	20	0.21

6.1.3.3 Testing Lab Renovation Work

To ensure smooth operation of Meter Management Group (MMG) and establish a robust quality chain of meters and accessories with in area of operations, meter testing labs to be developed at Cuttack circle with new test bench facility. These will be made operational in FY-21-22 and in subsequent years it will be brought under NABL umbrella.

In this lab there shall be storage facility available for meters and allied equipment (10x10 Room) in addition to the existing structure. In existing structure there will be requirement for civil work with respect to false celling, luminous level and cooling to adhere the requirements of IS-17025:2019

The table below provides the tentative cost for developing of one MMG Lab. The total cost of refurbishment of one labs will be **Rs 1.16 Cr** as shown below

Table 6-5: Development of MMG Lab

Sr No	Description	Qty	Cost	Total Cost (Rs Cr)
1	Creation of Bay measure (10 x 16.5 m) including false ceiling, CC flooring, Bath and Toilet (10.5 M x 5 M) etc as required by NABL Accredition	1	0.56	0.56
2	Construction of Structural Shed	1	0.45	0.45
3	Furniture , Admin and Supervision Charges etc	1	0.15	0.15
	Total		**1.16**	**1.16**

6.1.3.4 Proposal for NABL Accreditation of Meter testing Laboratories at Bhubaneswar & Cuttack

National Accreditation Board for Testing and Calibration Laboratories (NABL) is an autonomous body under the aegis of Department of Science & Technology, Government of India, and is registered under the Societies Act 1860. NABL has been established with the objective to provide Government, Industry Associations and Industry in general with a scheme for third-party assessment of the quality and technical competence of testing and calibration laboratories. Government of India has authorized NABL as the accreditation body for Testing and Calibration Laboratories.

Laboratory accreditation uses criteria and procedures specifically developed to determine technical competence. Specialist technical assessors conduct a thorough evaluation of all factors in a laboratory that affect the production of test or calibration data. The criteria are based on the international standards called ISO/IEC 17025, which are used for evaluating laboratories throughout the world.

Laboratory accreditation bodies use this standard specifically to assess factors relevant to the laboratory's technical competence, including the:-

- ✓ technical competence of staff.
- ✓ validity and appropriateness of test methods.
- ✓ traceability of measurements and calibrations to national standards.
- ✓ suitability, calibration and maintenance of test equipment.
- ✓ testing environment.
- ✓ sampling, handling and transportation of test items.
- ✓ quality assurance of test and calibration data.By this process, laboratory accreditation aims at assuring the consumers that the laboratory's test or calibration data are accurate and reliable.

It is very much essential to maintain our testing equipment updated to meet the requirements for testing of present day single/ three phase energy meters manufactured in the country. It is also a requirement on the part of the Licensee to obtain accreditation of the testing laboratories from National Accreditation Board for Testing & Calibration Laboratories (NABL), India as per clause 102(ii)(d) of OERC Distribution (Conditions of Supply) Code,2019& Clause 17 (2)(Quality Assurance of Meters) of Central Electricity Authority dtd 17.03.2006. Prior to move towards obtaining NABL accreditation for the testing Laboratory, it has to be equipped to carry out testing & calibration of all types of Energy Meters.

Conditions for obtaining NABL Accreditation

- The Laboratory shall carry out its testing / calibration activities in accordance with ISO/IEC17025:2005.
- The Laboratory should have a valid legal identity.
- The Laboratory shall meet the requirements of regulators in relevant field.
- Laboratory shall be completely dust proof and should have limited authorized access.
- Separate chamber is required for calibration with proper lightening, temperature & humidity.
- The Laboratory should have qualified & trained manpower for testing & calibration activities. A dedicated team (Not transferable) is required.

It is therefore proposed to hire the services of consultant for getting such accreditation and cost is as given in the table below

Table 6-6: Cost of Consultant for Accreditation of Testing Lab

For accreditation of Laboratory consultant is required NABL Consultancy	Qty	Unit Cost	Total (in Rs)
Consultant required for NABL Accreditation of Bhubaneswar Lab & Cuttack Lab including training for 3 Phase meter test bench procured udner capex for FY 2020-21	2	1000000	2000000

6.1.3.5 Refurbishment of Existing Test Bench for development of labs in Khurda, Dhenkanal and Kendrapada

Presently we have five nos. of testing laboratories in TPCODL which are equipped with very old test benches & are not up to the standard and none of the reference standards has been calibrated since the date of installation. TPCODL is in process of procuring new fully automatic test benches for Bhubaneswar & Cuttack Laboratory with which we can initiate the

accreditation process. To utilize the existing benches available in Bhubaneshwar lab, it is proposed to refurbish the available bench and shift them to Khurda Lab, Dhenkanal Lab and Kendrapada Lab. This will enable the labs to test the meters company owned and consumer owned with better precision.

Table 6-7: Refurbishment of existing meter testing facilities

Item	Quantity	Unit Cost (in Rs)	Total Cost
Fully Automatic Test Bench-MTE (Khurda)	1	3000000	0.3
Semiautomatic Test Benches (Dhenkanal & Kendrapada)	3	500000	0.15
Total			**0.45**

Testing Instruments for NABL Lab

In the state of Odisha there is no NABL Accredited Laboratory for testing & Calibration of Electrical Energy Meter .Accreditation body publish directory of their accredited laboratories- a potential means of promoting a laboratory accredited services to potential clients. NABL Accredited Laboratory can be a potential revenue earner for TPCODL. Incorporation of the systematic approach of relevant standard in working of laboratory provides better control of laboratory operations. Customers can search and identify the laboratories accredited by NABL for their specific requirements from the Directory of Accredited Laboratories. Laboratory accreditation is highly regarded both nationally and internationally as reliable indicator of technical competence.

As per NABL requirements the laboratory should be well equipped with testing facilities & equipment such as temperature & humidity indicator & recorder, Earth Resistance Tester, Atmospheric Pressure Indicator, Lux Meter, Supply Voltage Logger, Harmonic Meter, Digital Stop Watch, 41/2 Digit Multi-meter, Meter Test Bench with reference standard.

Table 6-8: Meter Lab Facilities

ITEM	Qty	Unit Cost (in Rs)	Total Cost (in Cr)
Megger	5	300000	0.15
Clamp On (Leakage-mA)	40	10000	0.04
Clamp On 1000A	40	8000	0.032
Tamper Testing Zig (1-Ph & 3-Ph))	1	600000	0.06
HV test kit(4KV)& IR	1	200000	0.02
Mandatory testing equipment for NABL Accreditation Lux Meter, Supply Voltage Logger, Harmonic Analyser , temperature, humidity recorder, Earth tester etc.	2	500000	0.1
Thermo Scanning Cameras-field	6	500000	0.3
RLC Panel (20A) Actual Load 3-ph	1	500000	0.05
Portable phantom Kit(1ϕ/3ϕ) for onsite testing	5	100000	0.05
Tool Box - Lab	7	2000	0.0014
		Total	**0.8**

6.1.4 DSS refurbishment

Brief description about the Scheme Proposed	Refurbishment of 11KV Distribution Substations of 500 KVA and 250 KVA
Capex Amount	Rs 12 Cr
Benefit to customer	1. Reliable Power supply 2. Ensure safety to field teams, Public and Animal 3. Flexible to operate
Existing System in place	Distribution Substation (DSS) comprises of various equipment which perform specific task to ensure delivery of power supply at appropriate voltage to the end consumers. Main components are 11 kV Switching device, 11 kV Protection, Transformer, LV Protection, Earthing, fencing and O/G LV feeders. The most expensive equipment in the DSS is Transformer and its life depends upon healthy condition of all other components be it LV Protection, HV Protection, Earthing or fencing. The age of Transformer can be enhanced by ensuring healthiness of all other components.

	It is therefore become important to maintain all the equipment in Distribution Substation healthy so that pre-mature failure due to any reason be it absence of proper earthing or absence of HV or LV protection can be avoided. During the survey, it is observed that lot of hotspot exists in the DSS causing jumper parting etc resulting into interruptions to the consumer. LV protection at most of the places are through Kit Kat fuses which are installed at very low level and posing a safety threat to the employees, animals and Public at large. Last year we have considered the refurbishment of 1136 no.s DSS of various capacity work of which is expected to be completed before onset of the Summer.
Need of the Project/ Statutory Compliance	Refurbishment of DSS helps in improving the overall efficiency safety by removing all old joints with new one, crimping of Lugs through Crimping tool, new earthing of the substation, replacement of faulty AB switches and corn out jumpers, provision of LT protection through LT ACB or MCCB etc.
Proposal for the Capex investment	In this proposal, TPCODL intends to carry out DSS refurbishment for **200 no.s** of 500KVA DSS and **150 No.** of 250KVA DSS.
Cost estimate	Detailed cost estimate is as follows

The breakup of the Expenditure along with the Bill of Quantities (BOQ) is as given in the tables below

Table 6-9: Breakup of expenditure on DSS Refurbishment

Sr No	Nature of Expenditure	No of Transformers Planned	Rs Cr
1	250 KVA Distribution Transformer Refurbishment	150	3.44
2	500 KVA Distribution Transformer Refurbishment	200	8.57
	Total		**12.01**

Table 6-10: Cost Estimate for 250 kVA Distribution Substation Refurbishment – 150 Nos

Sl. No	Item Description	Unit	Unit Rate	Qty	Total Amount
1	ACB LT 400A	EA	39,625	150	59,43,750
2	CLAMP TOP HAMPER FOR 11 KV PCC POLE.	EA	238	300	71,331
3	11KV PIN INSULATOR 5 KN COMPOSIT POLYMER	EA	236	900	2,12,400
4	GO SWITCH FOR 11 KV 200 AMPS	EA	9,960	150	14,94,000
5	LA 12KV 10KA FOR 11KV POLYMERIC	EA	3,550	450	15,97,500
6	FUSE UNIT DD 11KV 200A 1P SIL.RUBBER W/B	EA	1,600	450	7,19,960
7	FUSE ELEMENT FOR 11KV DD FUSE 20A WHITE	EA	58	450	26,019
8	CONDUCTOR ACSR RABBIT PVC 61.70 SQMM	M	56	3,450	1,94,546
9	1Cx400 sqmm LT cables XLPE (Armour) for 250KVA S/s	M	636	2,400	15,26,856
10	GLAND FOR ARM CABLE 1Cx400 sqmm LT cables XLPE (Armour)	EA	227	600	1,35,936
11	ISMC-125*65 GI Channel (13.3KG/M)	KG	121	13,229	16,01,971
12	ISMC-100*50 GI Channel (9.76KG/M)	KG	121	8,937	10,82,271
13	ISMC-75*40 GI Channel (7.24KG/M)	KG	121	14,954	18,10,869
14	ISA-50*50*6 GI Angel (4.6KG/M)	KG	121	11,331	13,72,184
15	FLAT GI SIZE 50X6MM	KG	89	7,638	6,75,963
16	FLAT GI SIZE 25X6 MM	KG	89	2,526	2,23,551
17	BOLT & NUT GI 12MMX50MM HEX	KG	97	908	87,810
18	WASHER GI SIZE 16MM DIA	KG	118	683	80,535
19	WASHER GI SIZE 12MM DIA	KG	118	291	34,338
20	LUG AL CRIMPING 95 SQMM XLPE SINGLE HOLE	EA	9	1,500	13,800
21	LUG AL 70 SQMM FOR 7/8 SWG WIRE/EARTHING	EA	8	8,100	64,233
22	LUG AL CRIMPING 150 SQMM XLPE ONE HOLE	EA	16	1,200	18,672
23	BIRD CAP FOR 9KV 5KA SURGE ARRESTER	EA	280	450	1,25,847
24	TEMPLETE FOR TRANSFORMER MAINT.RECORD	EA	80	150	11,948
25	40mm nominal bore GI pipe (medium gauge) earthing device with 3 mtr .Long	EA	1,239	1,050	13,00,950
26	PIPE HDPE SIZE 25 MM	M	36	3,450	1,24,373
27	WIRE STAY GI 7/10 SWG	KG	89	10,905	9,65,093
28	CONNECTOR MINI WEDGE 25 SQMM TO DOG	EA	216	450	97,254
					2,16,13,958
				Rs Cr	2.1614
	Total cost of materials for the year 2018-19				2,16,13,957.56
	Stock, Storage & Insurance = 3% of (A.)				6,48,418.73
	Sub total				2,22,62,376.29
	T & P charges = 2% of (B.)				4,45,247.53
	Contingency = 3% of (B.)				6,67,871.29
	Transportation Charges = 7.5% of (B.)				16,69,678.22
	Erection Charges = 10% of (B.)				22,26,237.63
	Sub Total				2,72,71,410.95
	Over Head Charges = 6% of (C.)				16,36,284.66
	Total Estimated Capital Cost				2,89,07,695.61
	GST @18% of (I)				5203385.21
	CESS @ 1% of (D.)				289076.96
	Total				34400157.77
				Rs Cr	3.44

Table 6-11 Cost Estimate for 500 kVA Distribution Substation Refurbishment- 200 no.s

S No.	Item Description	Unit	Qty	Unit Rate	Total Amount
1	ACB LT 400A	EA	400	39,625	1,58,50,000
2	BOARD DANGER 11KV SIZE 8X10 INCH	EA	400	94	37,760
3	40mm nominal bore GI pipe (medium gauge) earthing device with 3 mtr .Long	EA	1400	1,239	17,34,600
4	LUG AL CRIMPING 95 SQMM XLPE SINGLE HOLE	EA	4800	9	44,160
5	FUSE ELEMENT FOR 11KV DD FUSE 30AMP PINK	EA	600	61	36,816
6	WIRE STAY GI 7/10 SWG	KG	15000	89	13,27,500
7	1XC 400sqmm LT cables XLPE (armoured) for 500KVA s/s	M	12800	466	59,67,872
8	LUG AL CRIMPING 1XC 400sqmm LT cables XLPE (armoured)	EA	3200	136	4,34,240
9	ISMC-75*40 GI Channel (7.24KG/M)	KG	34000	121	41,17,400
10	ISA-50*50*6 GI Angel (4.6KG/M)	KG	14000	121	16,95,400
11	FLAT GI SIZE 50X6MM	KG	6000	89	5,31,000
12	BOLT & NUT GI 16MMX75M HEX	KG	2000	97	1,93,520
13	BOLT & NUT GI 12MMX75MM HEX	KG	1000	97	96,760
14	BOLT & NUT GI 16MMX200MM HEX	KG	1000	97	96,760
15	WASHER GI SIZE 12MM DIA	KG	100	118	11,800
16	WASHER GI SIZE 16MM DIA	KG	100	118	11,800
17	TEMPLETE FOR TRANSFORMER MAINT.RECORD	EA	200	80	15,930
18	CONNECTOR PALM LT BRASS 1000A 630KVA TRF	EA	800	1,350	10,79,936
19	150X 150mm RS joist (11 Mtr long)(30.6 ky Per meter)(Each 336.6kg)	EA	200	25,817	51,63,444
20	FRP CROSS ARM 1150MM 11KV	EA	400	499	1,99,760
21	CLAMP TOP HAMPER FOR 11 KV PCC POLE.	EA	400	238	95,108
22	11KV PIN INSULATOR 5 KN COMPOSIT POLYMER	EA	1200	236	2,83,200
23	GO SWITCH FOR 11 KV 200 AMPS	EA	200	9,960	19,92,000
24	LA 12KV 10KA FOR 11KV POLYMERIC	EA	600	3,550	21,30,000
25	ANTICLIMBING DEVICE FOR 11 M PCC POLE	EA	400	242	96,760
26	FUSE UNIT DD 11KV 200A 1P SIL.RUBBER W/B	EA	600	1,600	9,59,946
27	CONDUCTOR ACSR RABBIT PVC 61.70 SQMM	M	4600	56	2,59,394
28	BIRD CAP FOR 9KV 5KA	EA	600	280	1,67,796
29	CONNECTOR MINI WEDGE 25 SQMM TO DOG	EA	600	216	1,29,672
30	BUS BAR COPPER HDT SIZE 75X10MM	M	200	2,191	4,38,240
31	PIPE HDPE SIZE 25 MM	M	2400	36	86,520
32	CABLE 1.1KV AL 4CX300 SQMM XLPE ARM	M	6000	1,198	71,86,740
33	JT. KIT O/D 1.1KV XLPE 4X300 SQ.MM HS	EA	800	1,472	11,77,904
34	FLAT GI SIZE 25X6 MM	KG	2000	89	1,77,000
35	BOLT & NUT GI 12MMX50MM HEX	KG	200	97	19,352
					5,38,46,090
				Rs Cr	5.38
	Total cost of materials for the year 2018-19				5,38,46,090
	Stock,Storage & Insurance = 3% of (A.)				16,15,383
	Sub total				5,54,61,473
	T & P charges = 2% of (B.)				11,09,229
	Contigency = 3% of (B.)				16,63,844
	Transportation Charges = 7.5% of (B.)				41,59,610
	Errection Charges = 10% of (B.)				55,46,147
	Sub Total				6,79,40,305
	Over Head Charges = 6% of (C.)				40,76,418
	Total Estimated Capital Cost				7,20,16,723
	GST @18% of (I)				1,29,63,010
	CESS @ 1% of (D.)				7,20,167
	Total				8,56,99,900
				In Cr	8.57

6.2 Loss Reduction

6.2.1 Meter Replacement:

During various site visit and review of data base it has been seen that about 6 Lakh meters are still electromechanical meters. As per CEA (Installation and Operations of Meters) regulations 2006, Clause 4(1) and Clause 4(2), there should be No Mechanical Meter in utilities. The Abstract of clause 4 (1) and (2) of CEA (Installation and Operations of Meters) regulations 2006.

Clause 4 (1) : All interface meters, consumer meters and energy accounting and audit meters shall be of static type.
Clause 4(2) : The meters not complying with these regulations shall be replaced by the licensee on his own or on request of the consumer. The meters may also be replaced as per the regulations or directions of the Appropriate Commission or pursuant to the reforms programme of the Appropriate Government.

The same is also covered in OERC supply code 2019 clause no 97

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More over all these mechanical meters are more than 10 years old and have already completed their useful life. The above issues are resulting into reduction in billing efficiency, high AT&C losses and thus hampers the collection efficiency. Therefore under this head, Replacement of Electromechanical / Burnt / Faulty / Meters is being planned

It is learnt that nearly 5.8 lacs meters are reported to be Electromechanical. Further it is estimate 70 thousands meters are likely to become defective in FY 21-22. In addition, there will be 10,000 meters that are expected to be non-compliant In electromechanical and defective meter cases, it is estimated that service cable replacement would be required wherever found defective or missing and thus certain quantum of service cable is also considered in the plan. For installation of Meters, Meter box will also be installed to protect the meters from energy theft. In FY 21-22, it is planned to replace / install around **2.91 Lacs** meters which are directly contributing to the non-technical losses or are not in line with statutory regulations and accordingly capex investment of **Rs. 113.04 Cr** will be required for replacement of these meters.

Below Tables elaborate the quantum of capital expenditure required for Meter Replacement:

Table 6-12 : Cost of Meters to be replaced

Meter Replacement Budget							
Type of meter	Reason for replacement	Count of Meters	Cost per Unit (Rs)	Supply cost (Rs Cr)	Installation Rate / Unit (Rs)	Installation Cost (Rs Cr)	Total Cost (Rs Cr)
Single Phase SMART	Consumption > 300 units			Separately Shown			
Single Phase Meter	Old Defective Meters	0	701.23	0.00	599.12	0.00	0.00
	New Defective Expected	56000		3.93	599.12	3.36	7.28
	Electromechanical Meter	400000		28.05	599.12	23.96	52.01
Three Phase Whole Current meters	AMR Non compliant meters	31500	6916.65	21.79	483.35	1.52	23.31
	Defective Meters	0		0.00	749.61	0.00	0.00
	Electromechanical Meter	0		0.00	749.61	0.00	0.00
Three Phase LT CT meters	AMR Non compliant meters	400	4827.76	0.19	1342.9	0.05	0.25
	Defective Meters	100		0.05	1816.06	0.02	0.07
	Electromechanical Meter	0		0.00	1816.06	0.00	0.00
Three Phase HT CT meters	AMR Non compliant meters	100	6916.65	0.07	1547.62	0.02	0.08
	Defective Meters	50		0.03	1547.62	0.01	0.04
	Electromechanical Meter	0		0.00	1547.62	0.00	0.00
Grand Total		488150		54.11		28.94	83.05
	Grand Total (in Cr)						83.05

Cost of meters box supply for LT meters and for 11KV and 33 KV cost includes supply + installation cost.

Table 6-13 : Cost of Meter Boxes along with replacement of meters

Boxes	Count of Meter Box	Cost per unit (Rs)	Supply Cost (Rs Cr)
Single phase	456000	98.54	4.49
Single phase SMART	0		0.00
Poly Phase	31500	600.00	1.89
LTCT	500	5829.34	0.29
CTPT unit 11 KV	40	40263.00	0.16
CTPT unit 33 KV	10	64397.00	0.06
Total	488050		6.90
G Total	488050		

Cost of Cables required or installation of meters. These cases are considered to be utilised in the cases where the service line is already damaged or are having joints from where pilferage is possible.

Table 6-14 : Cost of cable for cable installation for meter replaced

Cable Size (Sq mm)	Cable length - (in KM)	Cost per M of Cable (Rs)	Cost of Cable supply (Rs Cr)	Rate of Installation (Rs / Cable)	Inst. cost (Rs Cr)	Total Cost (Rs Cr)
2*4	2394	36.48	8.73	456.66	5.00	13.73
2*10	1231.2	54.50	6.71	543.36	1.49	8.20
4*10	0.0	69.27	0.00	578.53	0.04	0.04
4*25	0.0	127.00	0.00	624.30	0.14	0.14
4*95	3.2	340.50	0.11	1922.10	0.02	0.13
4*150	2.2	523.10	0.11	1922.10	0.01	0.12
Grand Total			15.67		**6.70**	**22.36**

Cost of Accessories which will be required for installation of the meters where defective meters are to be replaced.

Table 6-15 : Cost of accessories for meter replaced

Accessories	Count of Accessories	Cost per unit (Rs)	Material Cost (Cr)	Rate of Installation / Unit (Rs)	Installation Cost (Rs Cr)	Total Cost (in Cr)
Modem	0	4012.00	0.00	284.79	0.00	0.00
Poly carbonate seals	1610895	4.54	0.73	0.00	0.00	0.73
Sationary and its Printing (Meter Change Sheet, JSA booklet etc)	1	200000	0.02	0	0.00	0.02
Total			0.73		0.00	0.73

6.2.2 Infrastructure for Spot Billing and Spot Collection:

The Spot Billing system is a system, in which the meter reader visits the consumer's premises, records the energy meter reading and issues the energy bill on the spot using a hand-held Android Phone and Bluetooth Printer. Solution is ready to use Spot Billing Solution framework which can be easily customized and delivered quickly depending upon client requirement On Premise Deployment based on Preference Integration with ERP (SAP etc.) System it has Source Code Ownership & Unlimited users/devices.

For this initiative, Capex fund of **Rs 3.55 Cr**. is planned in this year

6.2.3 Equipment like Accu-check, CMRI, Digital Camera etc

Scheme Proposed	Electric theft is the main cause of AT&C loss. For increase the billing efficiency, collection efficiency and for reducing AT&C loss more priority given to testing of meters . For testing the meters & capturing the electric theft related evidences we required these Equipment, with the help of this we are able to catch the electric theft like tampered , bypass, CT reversal, CT missing, PT missing etc.
Capex Amount	Rs 0.92 Cr
Benefit to customer	After regularising the theft customers billing efficiency, collection efficiency will increase & ultimately the AT&C loss will reduce & customers getting accurate voltage & current which is low earlier due to theft.

The detailed cost involved in the scheme is mentioned below:

Enf- Purchase of Accucheck, Single phase	26.8 lacs
Enf-Purchase of Accucheck, Three phase	40 lacs
CMRI	16 lacs
Clamp On Meter	0.42 lacs
Digital Camera	2.4 lacs
3 Fold FRP ladder	6 lacs
Total	Rs 0.916 Crs

6.2.4 LT Bare conductor to AB conversion

Brief description about the Scheme Proposed	Replacement of LT bare conductor with LT AB Cable: The same resulted in reduced direct 'hooking' done on bare LT conductor lines thereby reducing commercial losses drastically in theft prone areas.
Capex Amount	Rs.19.01 Cr.
Benefit to customer	By executing the proposals as made in this head, 415V network can be strengthened and we would be able to serve our consumers in much better way. Following benefits are envisaged from this investment: 1. Reliable Power supply to the Consumers since bare conductor will get converted into insulated cable.

	2. Comparatively safer than the LT Bare conductor and eliminate the element of risk if comes in close proximity. 3. Simpler installation, as crossbars and insulators are not required. 4. Suitable for congested lanes as well. 5. Electricity theft is becomes hard as hooking would not be possible. 6. Less required maintenance and necessary inspections of lines.
Existing System in place	In TPCODL, LT network plays important role of the Power supply distribution system and spread across TPCODL 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. Although, LT AB cables exists in the system and constitute approx. 50% of the total LT network across pan TPCODL.
Need of the Project	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.
Proposal for the Capex investment	In this scheme, the proposed 19 CR budget will be utilized in 3 heads- 1) Conversion of Bare to AB 3X50 + 1X35 + 1X16 sqmm using 9mt PSC pole per KM cost is 5.38lakhs. (181 Ckt km length of existing 3ph Bare OH LT line is proposed for conversion with LT AB cable- 3X50 + 1X35 + 1X16 sqmm) & approx cost is 9.75 Cr 2) Conversion of Bare to AB 3X70 + 1X50 + 1X16 sqmm using 9mt PSC pole per KM cost is 5.96lakhs. (100 Ckt km length of existing 3ph Bare OH LT line is proposed for conversion with LT AB cable- 3X70 + 1X50 + 1X16 sqmm) & approx cost 5.96 Cr 3) Conversion of Bare to AB 1x35+ 1x25 using 9mt PSC pole per KM cost is 3.26lakhs (Total 101 Ckt Km length existing 1PH bare LT line is proposed for conversion with LT AB cable- 1X35 + 1 X 25 sqmm) & approx cost is 3.29 Cr. Approx. 382 KM length of LT OH bare Circuit, shall be converted to LT AB Cable in FY 21 - 22.

Cost estimate	Cost estimate of individual schemes are mentioned in the annexure. Note -Assumptions: 7 No's of new Pole have been considered with complete new stay set, coil Earthing along with conversion service cost. ABC Cable. In addition to it, 8Way LT Distribution BOX & 4Way Distribution BOX have been considered for cost calculations. The approx. consumer considered is 100No's in one KM of the LT line.

Based on the scope of work and the Bill of Quantities (BOQ) following, the break up of the capex scheme is as given in the table below:

Table 6-16 : Breakup of LT Bare conductor

Sr No	Type of Conductor	Length Ckt km	Per Unit Length (RsLakh/Km)	Total Capex (Rs Cr)
1	3 x50 +1 x 35+1 x 16 Sq MM	181	5.387	9.75
2	3 x70 +1 x 50+1 x 16 Sq MM	100	5.96	5.96
3	1 x 35+1 x 25 Sq MM)	101	3.260	3.29
	Total	**382**		**19.01**

Table 6-17: **BOQ for Conversion of 1KM 3ph4w LT OH line over 9mtr long PSC with average span 30mtr using 3X50+1X35+ 1X16mm2 ABC.**

Sl. No	Description of Materials	Unit	Qty	2018-19	
				Rate	Amount
1	2	3	4	5	6
1	9 Mtr. long 300 Kg. PSC Pole	No.	7	3000	21000
2	Concrete slab for base place size 2ftx2ftx2" thickness for each PSC pole	No.	7	514.5	3,601.50
3	LT Stay set Complete	Set	5	520	2600
4	7/12 SWG Stay Wire	K.g.	50	75	3750
5	LT Stay clamp (1.4 K.g./ Pair)	pair	5	110	550
6	LT Stay Insulator	No.	5	35	175
7	Fixing and concreting of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.	No.	5	2455.46	12277.3
8	Dead end clamp	No.	10	490	4900
9	Suspension clamp with I-Hook	No.	20	560	11200
10	Strain fittings	No.	8	70	560
11	Guy grip Dead end	No.	8	62.02	496.16
12	Nuts and Bolts	Kg	24	75	1800
13	Earthing Coil each 5th pole to earth	No.	7	183.3	1283.1
14	AB Cable(3 x50 + 1x35mm^2+1X16mm2)	K.m.	1.03	130000	133900
15	Sundries for survey, tree cutting, insulated tape etc.	LS	1	1400	1400
16	8W LT Distribution Box	No.	10	4000	40000
17	4W LT Distribution Box	No	10	2200	22000
18	Insulated Piercing connector, Type -A-Main 16 to 95mm2 & Tap 16-95Sqmm	No.	100	80	8000
19	Service cable 4sqmm two Phase 2Core Aluminium PVC Cable	Mtr	1000	15	15000
20	4Cx16 mm2 LT PVC Cable	Mtr	200	100	20000
21	2Cx6 mm2 LT PVC Cable	Mtr	200	30	6000
22	4Cx10 mm2 LT PVC Cable	Mtr	200	115	23000
23	Dismantling of 55Sqmm conductor & Transport to Store	KM	1	1000	1000
24	Dismantling of PSC pole with Transport to Store	No.	3	1000	3000
25	MISC expenses for Dismantling	LS	1	1000	1000
26	Total Cost of materials				3,38,493.06
27	Stock, Storage & Insurance i.e 3% of A				10,154.79
28	Sub Total				3,48,647.85
29	Contingency @ 3% of (A+B)				10,459.44
30	Tools & Plants @ 2% of (A+B)				6,972.96
31	Transportation @ 7.5% of (A+B)				26,148.59
32	Erection Charges @ 10% of (A+B)				34,864.79
33	Sum of (A to F)				4,27,093.62
34	Other overheads (Including 6% supervision charges)				25,626.00
35	Total Estimated Capital Cost (G+H)				4,52,720.00
36	Total GST @ 18% of (I)				81,489.60
37	CESS @ 1% of (I)				4,527.00
	Gross Total cost of estimate				5,38,737.00

Table 6-18 **BOQ for conversion of 1KM 3ph4w LT OH line over 9mtr long PSC POLE with average span 30mtr using 3X70+1X50+ 1X16mm2 ABC .**

Sl No	Description of Materials	Unit	Qty	2018-19	
				Rate	Amount
1	2	3	4	5	6
1	9 Mtr. long 300 Kg. PSC Pole	No.	7	3000	21000
2	Concrete slab for base place size 2ftx2ftx2" thickness for each PSC pole	No.	7	514.5	3,601.50
3	LT Stay set Complete	Set	5	520	2600
4	7/12 SWG Stay Wire	K.g.	50	75	3750
5	LT Stay clamp (1.4 K.g./ Pair)	pair	5	110	550
6	LT Stay Insulator	No.	5	35	175
7	Fixing and concreting of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.	No.	5	2455.46	12277.3
8	Dead end clamp	No.	10	490	4900
9	Suspension clamp with I-Hook	No.	20	560	11200
10	Strain fittings	No.	8	70	560
11	Guy grip Dead end	No.	8	62.02	496.16
12	Nuts and Bolts	Kg	24	75	1800
13	Earthing Coil each 5th pole to earth	No.	7	183.3	1283.1
14	AB Cable(3 x95 + 1x70mm^2+1X16mm2)	K.m.	1.03	165000	169950
15	Sundries for survey, tree cutting, insulated tape etc.	LS	1	1400	1400
16	8W LT Distribution Box	No.	10	4000	40000
17	4W LT Distribution Box	No	10	2200	22000
18	Insulated Piercing connector, Type -A-Main 16 to 95mm2 & Tap 16-95Sqmm	No.	100	80	8000
19	Service cable 4sqmm two Phase 2Core Aluminium PVC Cable	Mtr	1000	15	15000
20	4Cx16 mm2 LT PVC Cable	Mtr	200	100	20000
21	2Cx6 mm2 LT PVC Cable	Mtr	200	30	6000
22	4Cx10 mm2 LT PVC Cable	Mtr	200	115	23000
23	Dismantling of 55Sqmm conductor & Transport to Store	KM	1	1000	1000
24	Dismantling of PSC pole with Transport to Store	No.	3	1000	3000
25	MISC expenses for Dismantling	LS	1	1000	1000
26	Total Cost of materials for the Year 2018-19				3,74,543.06
27	Stock, Storage & Insurance i.e 3% of A				11,236.29
28	Sub Total				3,85,779.35
29	Contingency @ 3% of (A+B)				11,573.38
30	Tools & Plants @ 2% of (A+B)				7,715.59
31	Transportation @ 7.5% of (A+B)				28,933.45
32	Erection Charges @ 10% of (A+B)				38,577.94
33	Sum of (A to F)				4,72,579.71
34	Other overheads (Including 6% supervision charges)				28,355.00
35	Total Estimated Capital Cost (G+H)				5,00,935.00
36	Total GST @ 18% of (I)				90,168.30
37	CESS @ 1% of (I)				5,009.00
	Gross Total cost of estimate				5,96,112.00

Table 6-19 **BOQ for conversion of 1KM 3ph4w LT OH line over 9mtr long 116x100 RS Joist Pole PSC with average span 30mtr using 1X35+1X25mm2 ABC .**

Sl.	Description of Materials	Unit	Qty	2018-19	
				Rate	Amount
1	2	3	4	5	6
1	9 Mtr. long 300 Kg. PSC Pole	No.	7	3000	21000
2	Concrete slab for base place size 2ftx2ftx2" thickness for each PSC pole	No.	7	514.5	3,601.50
3	LT Stay set Complete	Set	5	520	2600
4	7/12 SWG Stay Wire	K.g.	50	75	3750
5	LT Stay clamp (1.4 K.g./ Pair)	pair	5	110	550
6	LT Stay Insulator	No.	5	35	175
7	Fixing and concreting of stay set with 0.5Cum cement concrete foundation 1:3:6 size (900mmx600mmx900mm) using 40mm BHG metal with all labour and material except stay set, stay wire, stay insulator.	No.	5	2455.46	12277.3
8	Dead end clamp	No.	10	490	4900
9	Suspension clamp with I-Hook	No.	20	560	11200
10	Strain fittings	No.	8	70	560
11	Guy grip Dead end	No.	8	62.02	496.16
12	Nuts and Bolts	Kg	24	75	1800
13	Earthing Coil each 5th pole to earth	No.	7	183.3	1283.1
14	AB Cable(1x35+1X25mm2)	K.m.	1.03	42000	43260
15	Sundries for survey, tree cutting, insulated tape etc.	LS	1	1400	1400
16	8W LT Distribution Box	No.	10	4000	40000
17	4W LT Distribution Box	No	10	2200	22000
18	Insulated Piercing connector, Type -A-Main 16 to 95mm2 & Tap 16-95Sqmm	No.	100	80	8000
19	Service cable 4sqmm two Phase 2Core Aluminium PVC Cable	Mtr	1000	15	15000
20					
21	2Cx6 mm2 LT PVC Cable	Mtr	200	30	6000
22					
23	Dismantling of 55Sqmm conductor & Transport to Store	KM	1	1000	1000
24	Dismantling of PSC pole with Transport to Store	No.	3	1000	3000
25	MISC expenses for Dismantling	LS	1	1000	1000
26	Total Cost of materials for the Year 2018-19				2,04,853.06
27	Stock, Storage & Insurance i.e 3% of A				6,145.59
28	Sub Total				2,10,998.65
29	Contingency @ 3% of (A+B)				6,329.96
30	Tools & Plants @ 2% of (A+B)				4,219.97
31	Transportation @ 7.5% of (A+B)				15,824.90
32	Erection Charges @ 10% of (A+B)				21,099.87
33	Sum of (A to F)				2,58,473.35
34	Other overheads (Including 6% supervision charges)				15,508.40
35	Total Estimated Capital Cost (G+H)				2,73,981.75
36	Total GST @ 18% of (I)				49,316.71
37	CESS @ 1% of (I)				2,739.82
	Gross Total cost of estimate				3,26,038.28

6.3 Reliability Improvement

6.3.1 SCADA Implementation

This is a part of the Road Map Scheme and has been explained under the different section

6.3.2 GSAS Implementation

Brief description of the Scheme Proposed	All the grids in TPCODL are proposed to be automated for operation through SCADA system. To enable equipment operation through SCADA, control and relay panel at 33/11KV substation needs to be replaced with new panels fitted with state-of-art IEDs and data concentrator. These substations shall be equipped with devices to make all control, monitoring and protection signal available at remote control center for efficient control and monitoring of electrical network.
Capex Amount	Rs.35.11 Cr.
Benefit to customer	1. Better Control and operation through Remote Operation. 2. Faster Changeover and quick restoration of Supply

The details of the expenditure is as given below

Table 6-20 **Cost estimate considering the equipment for GSAS implementation**

TP CENTRAL ODISHA DISTRIBUTION LIMITED

(A Tata Power & Odisha Govt. joint venture)

Sl. no.	Item Description	Rate	Quantity	Total Cost
1	Retrofitting of DCDB for SCADA Compatibility	1,00,000.00	70	70,00,000.00
2	33KV 4W RMU	24,00,000.00	1	24,00,000.00
3	11KV 4W RMU BUS PT	5,00,000.00	20	1,00,00,000.00
4	TMU	6,03,735.29	70	4,22,61,470.30
5	Earthing System	1,00,000.00	80	80,00,000.00
6	Switchyard Fencing (120 mtrs)	7,23,000.00	170	12,29,10,000.00
7	Master Trip Relay	20,000.00	700	1,40,00,000.00
8	Fire Detection and Alarm System	2,00,000.00	70	1,40,00,000.00
A.	**Total cost of materials**			**22,05,71,470.30**
I.	Stock, Storage & Insurance = 3% of**(A.)**			66,17,144.11
B.	**Sub total**			**22,71,88,614.41**
I.	T & P charges = 2% of **(B.)**			45,43,772.29
II.	Contingency = 3% of **(B.)**			68,15,658.43
III.	Transportation Charges = 7.5% of **(B.)**			1,70,39,146.08
IV.	Erection Charges = 10% of **(B.)**			2,27,18,861.44
C.	**Sub Total**			**27,83,06,052.65**
I.	Over Head Charges = 6% of **(C.)**			1,66,98,363.16
D.	**Total Estimated Capital Cost**			**29,50,04,415.81**
I.	GST @18% of (**I**)			5,31,00,794.85
II.	CESS @ 1% of (**D.**)			29,50,044.16
E.	**Total**			**35,10,55,254.81**
	Total Cost estimate in Crores			35.11

6.3.3 33KV and 11KV Sick Equipment Replacement

Brief description about the Scheme Proposed	The Power distribution network & its equipment health is a critical factor for ensuring reliable & quality power supply to the end consumers. Although field teams are committed to upkeep the equipment by doing preventive maintenance, but still some of the equipment gets faulty and may result into pre-mature failure due to frequent tripping. Pre-mature failure of the equipment results into long duration outage as it becomes difficult to restore the power supply if it happens during odd hours or if spare equipment is not available in the inventory. Hence, to ensure highest reliability, all equipment needs to operate properly at all the time. In last 7 months of operations, TPCODL has done the survey to identify the sick equipment exists in the system which may fail or lying faulty and proposed for their replacement so that reliability to the end consumers can be ensured. In this scheme, we have proposed replacement of faulty network equipment in phase manner at priority locations.
Capex Amount	Rs.15.48 Cr.

Benefit to customer	TPCODL intends to implement the following actions to improve the reliability of power supply 1. Identification and replacement of faulty / sick equipment causing frequent tripping's. 2. Introduction of new technology to ensure faster restoration of supply in case of any tripping.
Existing System in place	For any distribution company, healthy & trouble free network equipment or asset base, is a must, apart from strong 33KV & 11KV network. It forms the base for reliable power supply to the customer. In TPCODL, based on the detailed survey reports, it was found that at some places intervention at Equipment level is required to make the network strong & trouble free, so as to ensure reliable power distribution till customer point.
Need of the Project	To strengthen the existing network, it is suggested to replace the sick equipment in the existing network. Further, this replacement will help in utilization of the resource to the optimum level, managing the load in case of any exigency and mitigate the issue of overloading etc.
Proposal for the Capex investment	The detailed proposal and scope of work has been mentioned in the individual schemes which are attached as Annexure - .
Cost estimate	Cost estimate of individual schemes are mentioned in the annexure.

Table 6-21 **Estimation of expenditure on sick Transformer replacement summary table**

Item description	QTY	UNIT	Per unit price	Total Amount (Rs Cr)
Augmentation of Power Transformer from 7.5 MVA to 12.5 MVA at 33/11 KV Infocity structure	2	NO	21812228	4.36
Augmentation of Power Transformer from 5 MVA to 8 MVA at 33/11 kV Bharatpur Structure	1	NO	11152550	1.12
Total cost in Cr				**5.48**

Additionally, Rs 10 Cr budget is proposed for Sick equipment replacement to improve reliability of Power supply. Also, to ensure better operation & control of the network & faster restoration of supply in case of interruptions. This requirement is for 178 Nos of substation pan TPCODL.

Table 6-22 BOQ for Sick Equipment replacement (VCB, CT/PT, CRP, Isolator)

Sl. No.	Item-Description	Unit	Qty.	Rate	Total Price
1	2	3	4	5	6
1	33KV VCB -800A	EA	25	3,00,000.00	75,00,000
2	33KV CT- 800-400-200/1-1-1	EA	70	46,000.00	32,20,000
3	33KV PT	EA	35	40,000.00	14,00,000
4	33KV Control Relay Panel For Transformer	EA	10	4,50,000.00	45,00,000
5	33KV Control Relay Panel For IC/OG	EA	12	3,00,000.00	36,00,000
6	11KV VCB - 1200A	EA	50	2,50,000.00	1,25,00,000
7	11KV CT- 300-600/1-1, 400-800-1200/1-1-1	EA	50	30,000.00	15,00,000
8	11KV PT	EA	30	30,000.00	9,00,000
9	11KV Control relay panel	EA	15	2,50,000.00	37,50,000
10	33kv Isolator (800A)	EA	200	1,20,000.00	2,40,00,000
11	TOTAL OF SUPPLY				
A	GRAND TOTAL(1 to11)				6,28,70,000
B	Stock & Storage @ 3% of A				18,86,100
C	Sub - Total (A+B)				6,47,56,100
D	Contingency @ 3 %+T&P Charges @2%+Transportation 7.5%				1,45,70,123
E	Sub - Total (C+D)				7,93,26,223
F	Other Overheads including supervision charges @ 6%				47,59,573
G	Total estimated Capital Cost (E+F)				8,40,85,796
H	GST 18% of G				1,51,35,443
I	CESS 1% of G				8,40,858
J	**Total Cost**				**10,00,62,097**
	Total Cost (Rs Cr)				10.0

6.3.4 33KV System Improvement Schemes for feeders & Power Evacuation Scheme from OPTCL Grid

Brief description about the Scheme Proposed	In order to provide the reliable and Quality power supply to the consumers in TPCODL's Licensed area, we have conducted the survey of all 33KV feeders to identify the weaker section which require immediate attention. Based on the survey reports, it is observed that in some of the

	feeders, conductor sizes are different resulting into compromising the circuit capacity which is limited to the lowest size of the conductor available in the ckt. Reason behind such network is that post FANI, field teams restored the supply with whatever conductor sizes were made available to them. However, looking at the existing load demand and factoring the projected load growth, it is required to be rectified so as to avoid overloading of the network. Further, a SLD based network study carried out for Bhubaneswar and Cuttack city area and found that some interventions are required to be taken under Capex to provide alternate source to the existing 33KV feeders. This will help in optimizing the feeder loading and will support in shifting the load to another structure or OPTCL grid in case of any source failure. Moreover, in various forums, OPTCL has raised the issue of recently commissioned 220/33KV or 132/33KV which are either lightly loaded or even have no loading. OPTCL has asked TPCODL to evacuate power from these Grid substations and ease out the loading on other OPTCL Grids which are currently catering the load. Therefore, TPCODL is also proposing evacuation of Power from these OPTCL Grid substations by laying new 33KV feeders or interconnectors to transfer the load. This overall expenditure will help in strengthening the 33KV network to some extent since the requirement is huge but considering the resource availability, it will be done in phase manner.
Capex Amount	Rs 40 Cr.
Benefit to customer	By executing the proposals as made in this head, 33KV network can be strengthened and we would be able to serve our consumers in much better way. Following benefits are envisaged from this investment: 1. Reliable Power supply to the Consumers 2. Improving the Ckt capacity by replacing the weaker section with appropriate sized conductor. 3. By putting interconnectors, N-1 of the feeders will be ensured and load can be transferred to alternate source in case of any exigency.
Existing System in place	In TPCODL, 33KV network is the backbone of the Power supply system and spread across TPCODL licensed area and connected with various 33/11KV structures from where the power is transformed at 11KV for further distribution. 33KV Network is lengthy and radial in nature at

	most of the places. Also, post FANI, during the rectification job, in the absence of adequate quantity of required sizes, multiple sizes of conductor were used to restore the supply. Therefore, network capacity is limited to the lowest size of conductor present in the entire Ckt length. To summarize, we found following areas where interventions can be made to strengthen the existing network. • Lengthy and Radial connectivity of the network • Overloading of the 33 kV feeders • Absence of N-1 redundancy at least to critical installations. • Circuit capacity restricted to lower size of conductor in existing line. • Unavailability of the corridor for evacuation of power from lightly loaded or no – load OPTCL Grids.
Need of the Project	To strengthen existing 33KV network, it is suggested to lay some interconnectors in the existing network to make the system in ring and mitigate the issue of single connectivity. Further, this interconnection would help in managing the load in case of any exigency and mitigate the issue of overloading. Apart from the interconnectors, we have also proposed conductor augmentation in some cases to address the overloading issue. Also, new feeders have been proposed to evacuate power from the existing lightly loaded or recently commissioned OPTCL Grid substations.
Proposal for the Capex investment	The detailed proposal and scope of work has been mentioned in the individual schemes which are attached as Annexure - .
Cost estimate	Cost estimate of individual schemes are mentioned in the annexure.

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Table 6-23 33 KV Feeder wise improvement list

Sl. No	33 KV Feeder Name	Division	Proposal Details	Total Cost in Cr
1	FDR-5 (Sishubhawan)	CDD-1	Augmentation of existing 33 KV Sishubhawan Feeder from 100 sq.mm. to 232 sq.mm. from Sishubhawan Structure to Blue lagoon hotel	0.2
2	FDR-3 (SECTOR-6)	CDD-1	1) Power evacuation via 2 nos. feeder from CDA(Brajabiharpur) OPTCL Grid S/S by construction of 4.5 KM Double Ckt. Line. 2) Augmentation of 33 kV line from Bidanasi to Sector-VI S/S through H pole from 100 sq.mm to 232 sq.mm.	3.48
			For mitigating the Single connectivity issue at Satichaura S/S.	0.5
			For mitigating the Single connectivity issue at Sector 10 & 11 S/S.	0.86
3	FDR-4 (BAHUGRAM)	CDD-2	For Strenthening of 33 kV connectivity of Bahugram feeder by installing 3 Way 33 kV RMU inside Jagatpur S/S.	0.58
4	FDR-2 (TANGI)	CED	Augmentation of 33 kV line from Mania to 4 pole from 100 sq.mm. to 232 sq.mm. and to be extended by constructing New 33 kV Line to Tangi S/S.	2.12
5	FDR-1 (BALIKUDA)	CED	Addition of New Line from Phulnakhra Grid S/S to Gopalpur S/S.	3.39
			Mitigating Single connectivity of 33/11 kV Dahaliabag S/S by addition of New 33 kV line	1.53
6	FDR-1 (TULASIPUR 1)	CDD-1	Addition of New line from Tulsipur-2 feeder to Mathamatha S/S.	0.68
	FDR-2 (TULASIPUR 2)		Addition of New 33 kV line from CRRI to Mahanadivihar	2.66
7	FDR-1 (CHOUDWAR)	CED	Addition of New line from LILO from Bahugram feeder	0.65
	FDR-5 (JAGATPUR)	CDD-2	Addition of New line from 4 pole to Jagatpur(IPICOL) from Bahugram feeder	0.55
8	33 kV Line from Badachana S/S	CED	Augmentation of line from 55 sq.mm.to 100 sq.mm.	0.67
9	Damodarpur Feeder	CED	Addition of New line from LILO from Damodarpur feeder to Adaspur	1.72
10		CDD-2	Addition of New Line from Proposed RMU beside existing RMU for OSAP S/S	2
11	Narangabasta Feeder	AED	Addition of New Line upto 33 kV Narangabasata feeder from Khuntuni S/S	1.02
12	BADAMBADI FEEDER	CDD-2	Augmentation of line required for Badamnadi feeder(100 sq.mm. to 232 sq.mm.) from Sishubhawan S/S to 6 pole	0.46
13	CHANDRASEKHARPUR-1	BCDD-2	Existing CS Pur 1 structure to 4 Pole at Omfed square- Line Augmentation from 100 sq.mm to 232 sq.mm Overhead & UG 185 to 400 sq.mm, also one proposed RMU installation at 4 pole	0.78
14	CHANDRASEKHARPUR-2	BCDD-2	Addition 33 kv line from CS PUR 2 to Unit 8 feeder 1(Chandaka A).	1.53
15	XAVIER	BCDD-2	Addition 33 KV line from UNIT 8 Feeder 2(Chandaka A) to 33/11 KV Xavier structure.	2.46
16	XAVIER	BCDD-2	Addition 33 KV line from Nayapally feeder from chandaka A to 33/11 KV ESI structure.	0.37
17	BARANGA	BCDD-2	Isolator proposed at 33/11 KV New baranga structure.	0.018
18	ASOTECH	BCDD-2	Addition 33 KV line from Baramunda or Nayapally feeder from Ransingpur Grid.	0.64
19	NAYAPALLI	BCDD-2	Augmentation of 1.5 km from 80 sqmm to 232 sqmm for Unit 8 feeder 3.	0.2
20	SAILASHREE VIHAR FDR	BCDD-2	Addition 33 KV new line from PGCIL feeder to 33/11 KV Sailashree Vihar structure	0.16
21	UNIT-8 GIS-BARAMUNDA(FDR-3)	BCDD-1	Addition 33 KV line from T-point to 33/11 KV Delta structure.	0.42
22	NAYAPALLI	BCDD-2	Addition 33 KV new line from Nayapally feeder to 33/11 KV RRL structure.	0.37
23	KESURA	BED	Addition 33 KV new line from Feeder 5(Mancheswar A) to 33/11 kv pundara structure.	1.6
24	LINGIPUR	BED	Addition 33 KV new line from Pratapsasan OPTCL grid to 33/11 KV Silua structure.	1.94
25	MANCHESWAR TO 9 POLE	BED	Addition 33 KV new line from Mancheswar B to 9 pole.	2.8
26	MENDASAL GRID TO KALINGANAGAR	KHD	Addition 10 ckm 33 KV new line from Mendasal grid to 33/11 kv Kalinganagar structure.	3
27	SATSANGHA STRUCTURE	PED	Addition 33 KV Overhead new line from Satsankha grid to satsankha structure.	0.7
	Total			**40.058**

The details of the individual schemes in given **8 Annexure B**

6.3.5 33KV System Improvement schemes - Equipment like 33KV RMU

Brief description about the Scheme Proposed	In order to provide the reliable and Quality power supply to the consumers in TPCODL's Licensed area, we have conducted the survey of complete network & the equipment, to identify the deficiencies, which require immediate attention. Based on the survey reports, it is observed that in current network configuration, few circuits have the interconnectivity through AB switches but to transfer the load from one feeder to another feeder, both feeders are required to be switched off and only then load can be transferred. It is proposed to install 33KV RMU at all such locations which will give flexibility to field teams to transfer the load without giving any interruption to existing consumers.
Capex Amount	Rs.9.67 Cr.
Benefit to customer	By executing the proposals as made in this head, 33KV network can be strengthened and we would be able to serve our consumers in much better way. Following benefits are envisaged from this investment: 1. Reliable Power supply to the Consumers 2. By putting interconnectors, N-1 of the feeders will be ensured and load can be transferred to alternate source in case of any exigency.
Need of the Project	To strengthen existing 33KV network, it is suggested to lay some interconnectors in the existing network to make the system in ring and mitigate the issue of single connectivity. Further, this interconnection would help in managing the load in case of any exigency and mitigate the issue of overloading.
Proposal for the Capex investment	The detailed proposal and scope of work has been mentioned in the individual schemes which are attached as Annexure - .
Cost estimate	Cost estimate mentioned in the annexure.

Table 6-24 Summarized list of 33KV equipment (RMU) replacement

Sl. No.	Grid Name	33KV Feeder Name	Division	Proposal	Total Cost (Rs Lakhs)
1	MANCHESWAR GRID	FDR-1 (SAINIK SCHOOL)	BCDD-2	Proposal for installation of 3 Way 33KV-RMU at Sainik School, for load shifting using NBCC feeder.	38. 6
2	MANCHESWAR GRID	FDR-1 (SAINIK SCHOOL)	BCDD-2	Proposal for installation of 2 no.s of 4 Way 33KV -RMU at Unit 6.	90.01
3	RANASINGHPUR GRID	BHIMTANGI I AND BADAGADA	BED	Proposal for installation of 2 no.s of 3 way 33KV-RMU at Bhimtangi Structure	77.27
4	DIGHALO GRID	NIMAPARA AND AVAYAMUKHI	NED	Proposal for installation of 2 no.s of 3 Way 33KV-RMU at Nimapara	77.27
5	MANCHESWAR A AND B	Mancheswar-6, Mancheswar-4	BED	Proposal for installation of 3 no.s of 4 Way 33KV-RMU at 9 Pole	135.01
6	MANCHESWAR A , B ,KESURA	Laxmisagar-1 , Laxmisagar-2	BED	Proposal for installation of 1 no. 4 Way 33kV-RMU and 1 no of 5 Way RMU at 4 Pole for Laxmisagar	93.14
7	BBSR 1		BBSR 1	Conversion from T point to 33KV RMU- Total 11 no.s location at Bharatpur, Dumduma (2no.s), Unit-2 , Khandagiri (2nos) , Delta, ESI, Kalpana, Kalinganagar,	495.07
Total Cost (in Crore)					9.68

The details of the various schemes is given in Error! Reference source not found. Error! Reference source not found.

6.3.6 11KV System Improvement schemes – Feeders & Equipment like AB Switch, RMU, Load break switch, ACB & MCCB

Brief description about the Scheme Proposed	In TPCODL, most of the 11KV feeders are long and radial in nature. During contingency, it is not possible for the field teams to transfer the load to the healthy section and thus all consumers connected to the affected feeders remain out of service till the field team locate and repair the fault. This scheme is proposed to give flexibility to the field teams in 11KV feeder operation. At some locations there is no LT protection at Distribution Transformer and therefor to attend/work at LT feeder, outage to be taken from 33 KV/11 KV structure which results into interruption to all consumers connected to particular 11 KV feeder. By providing LT ACB or MCCB at these locations will address this issue and reliability will be enhanced.

	Moreover, in city area, interconnectors & load break switch is required to address the issue of overloading. In this head, all such issues can be mitigated by: 1. Laying new 11KV feeders 2. Augmenting the existing 11KV feeder to address overloading issues of the feeders. This will help in strengthening the existing 11KV system. 3. Installation of 11KV RMU at required locations 4. Installation of Load break switch.
Capex Amount	Rs. 21.91 Cr.
Benefit to customer	1. Reliable power supply to consumers 2. Improvement in Reliability Indices like SAIDI & SAIFI. 3. Ease of operation to the field teams 4. Improving the safety in terms of Equipment operation
Existing system in Place & Need of the Project	To strengthen & make existing 11KV network more reliable, it is suggested to install RMU, Load break switches, conductor augmentation with interposing poles etc in the existing 11kv network. This will help in converting the radial network into ring and mitigate the issue of single connectivity. Further, this interconnection would help in managing the load in case of any exigency and mitigate the issue of overloading. Apart from the interconnectors, we have also proposed conductor augmentation in some cases to address the overloading issue. Also, new feeders have been proposed to evacuate power from the existing lightly loaded feeders. With installation of RMU, equipment safety will increase for field operation team, with less maintenance & beautification of the network. SCADA implementation will become easy with smart Ring main units. With Load Break Switch, in 11KV feeders, field engineers would have flexibility to isolate the section locally instead of switching off entire feeder. In case of any tripping, maintenance engineer can isolate the faulty section and restore the supply of remaining consumers thereby improving the reliability. Consumer will experience less power cut and thus reduction in consumer complaint.

Proposal for the Capex Investment	The detailed proposal and scope of work has been mentioned in the individual schemes which are attached as Annexure - .
Cost Estimate	Cost estimate of individual schemes are mentioned in the annexure.

The breakup of the expenditure on 11 KV Feeders is summarized in the table below

Table 6-25: Breakup of Expenditure on 11 KV System Improvement Scheme and associated equipments

Sr No	Scheme under the Capex	Amt (Rs Cr)
1	11 KV Feeders	10.36
2	Load Break Switch	4.51
3	Trolley Mounted Distribution Transformer	2.31
4	Capex for Fault Location Cell	1.90
5	Capex for Inhouse Repairing of Switchgears	1.94
6	Pipe Earthing	0.88
	Total	**21.91**

Further the breakup of the expenditure under Sr No 1 and 2 above is given in the following tables:

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Table 6-26 11KV system Improvement Schemes for Feeders (A)

SL. NO.	DIVISION NAME	33/11 KV STRUCTURE NAME	11 KV FEEDER NAME	PROPOSAL	Total cost In Crs
1	BCCD-2	INFOCITY	NEW INDUSTRY-1	1.Augmentation of 11kv OH line of 0.4 ckm length from 55 sq mm to 100 sq.mm AAAC conductor.	0.29
				2. Addition of UG cable of 3Cx400 sq.mm of 0.07km length with two nos of 11 KV line DP with AB switch.	
				3. Augmentation of existing UG of infocity feeder of lentgh of 0.3ckm from 120 sq.mm to 400 sq.mm from infocity structure to Tcs.	
2	BED, BBSR	BADAGADA	BADAGADA LINGARAJ	1.Construction of new 11kv UG XLPE cable of 0.15ckm length of 400 sq.mm of two runs from Kanchi bhoisahi to near lingaraj temple with one 11kv 3 way RMU.	0.2
3	BED, BBSR	BHIMATANGI	POKHARIPUT-1	1. Addition of 11kv UG of 400 sq.mm cable of 0.15km is required with one line dp with AB switch to bifurcate the pokhariput-1 feeder.	0.13
4	BCCD-2	XAVIER	STPI	Augmentation of conductor of STPI feeder from 55 sq.mm to 100 sq.mm of 0.7Ckm length from Xavier structure to SBI ATM.	0.07
5	BCCD-2	SAINIK SCHOOL	SAINIK SCHOOL FEEDER	Augmentation of conductor from 55 sq.mm to 100 sq.mm from dasrathi basti to railway high school .	0.03
6	BCCD-2	KALARAHANGA	NANDAN VIHAR	Augmentation from 55 sq.mm to 100 sq.mm of nandan vihar feeder from kalarahanga structure to mani apartment.	0.15
7	BCCD-2	KALINGA NAGAR	K-5/KALINGA NAGAR	Augmentation of 4.5ckm length of k-5 feeder of Kalinga Nagar structure from 55 sq.mm to 100 sq.mm from kalinga nagar structure to trident square.	0.34
8	BCCD-2	VANIVIHAR ODSSP	INCOME TAX FEEDER	Installation of 11kv RMU 3 way infront of Vani vihar primary substation .	0.08
9	BCCD-2	KANAN BIHAR	KIIT	1.Installation one 11kv 3 way RMU at Shikharchandi Square. 2.Installation one 11KV 3 way RMU at sishu vihar square.	0.17
10	BCCD-2	KANAN BIHAR	PATIA	1) Installation of one 11kv 3 way RMU near Regal Apartment. 2) Installation of one 11kv 3 way RMU is required to install near patia 4 pole square.	0.17
11	BED, BBSR	BADAGADA	BADAGADA LINGARAJ	Installation of one 11kv 3 way RMU near north gate of lingaraj temple.	0.08
12	BCCD-2	CS PUR-2/SAISHREE VIHAR	CSPUR BDA -2	Installation of 11KV 3 way RMU infront of harihara college where it can be linked to BDA -2 feeder.	0.08
13	CED	TANGI	HARIPUR	Augmentation of Conductor size from 55 TO 100 sqmm of 25 km(Tangi Electric office to Haripur)	1.87
14	CED	TANGI	MANGULI	Augmentation of Conductor size from 55 TO 100 sqmm of 15 km(Brahmani Devi temple to Itua,Laphanga)	1.12
	Total				4.78

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Table 6-27 11KV system Improvement Schemes for Feeders (B)

SL. NO.	DIVISION NAME	33/11 KV STRUCTURE NAME	11 KV FEEDER NAME	PROPOSAL	Total cost In Crs
15	CED	TANGI	MANGULI	Addition of new 11KV OH line of length 0.5 km(Shakti Hotel to Manguli) having conductor size of 100 sqmm along with 2 runs of 0.120 km UG cable for NH-5 crossing and 2 nos AB switch with one four pole structure at Shakti Hotel.	0.25
16	CED	GOPALPUR	42 MOUZA	Augmentation of 11KV OH conductor size from 55 sqmm to 100 sqmm of 16 km from Orali Mallik Sahi to Dhanagharapada.	1.19
17	CED	GOPALPUR	BARANGA	Augmentation of 11KV OH conductor size from 55 sqmm to 100 sqmm of 12 km from Sadar police station to Pratapnagari mahadev sahi.	0.9
18	CED	GOPALPUR	BARANGA	1.Addition of nearly 2 Runs of 500 mtr 11KV UG cable for Railway crossing near Paikraypur cutoff point.	0.55
19	CED	GOPALPUR	UTTAMPUR	Augmentation of 11KV OH conductor size from 55 sqmm to 100 sqmm of 6 km from Kajipatna chhak to SVM Hospital	0.45
20	CDD-1	DRDA	KAZIBAZAR	Augmentation of 11kv OH line of 250 mtr length of Gangamandir feeder from 80 sqmm to 100 sqmm(from Gangamandir to Adipith)	0.02
21	CDD-2	OGP	INDUSTRIAL-2	Addition of new 11KV 0.1Km UG Cable at Balisahi.	0.07
22	CDD-2	JAGATPUR	OLD I.E	Addition of 1.2 km new OH 11kv line of 100 sqmm(from Naba Fly ash bricks,Nankar to Vaikuntha vihar) along with 100 mtr UG cable.	0.33
23	CDD-2	JOBRA	BARRAGE	1.Addition of 2 runs of 0.240 km 11 KV UG from Chuna Bhati to Survey & Map office Tower.	1.1
				2.Addition of 2 runs of 0.820 km 11 KV UG from Malgodown Police Station to Map Chhak.	
24	CDD-2	KANDARPUR	KANDARPUR	1.Addition of 400 mtr New 11 KV OH conductor of size 100 sqmm from Aurchili to Kampada and augmentation 55 to 100 sqmm of 5km (from Somepur structure to Archili).	0.46
25	CDD-1	SISUBHABAN	TOWNHALL	Addition of one outdoor VCB(400A) inside Sisubhaban structure.	0.05
26	CDD-1	DRDA	JUDGE COURT	Augmentation of 350 mtr OH 11 kv line of Judge Court Feeder from Alankar Nimchudi to Co-operative bank from(80 to 100 sq.mm.)	0.03
27	CDD-1	JOBRA	RAVENSHAW	Augmentation of 1.5 km 11kv OH conductor of size from 55/80 to 100 sqmm from Ravenshaw University campus to Pilligrim road.	0.11
28	CDD-2	CRRI	NAYABAZAR	Installation of one 11KV 3 way RMU at pota pokhari field.	0.07
				Total cost	5.58

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Table 6-28 Proposal for Installation of Load Break Switch (A)

SL. NO.	DIVISION NAME	33/11 KV STRUCTURE NAME	11 KV FEEDER NAME	PROPOSAL	Rs Cr
1	BED, BBSR	RASULGARH	RASULGARH FEEDER	Installation of one 11kv LBS with DP at Gangua bridge.	0.11
2	BED, BBSR	LAXMISAGAR	JHARAPADA	Installation of one 11kv LBS with DP near Haldipadia location.	0.11
3	BCCD-2	BARAMUNDA	CRPF FEEDER	Installation of two no.s of 11kv LBS with Line DP near Nayapalii medical.	0.22
4	BCCD-2	BARAMUNDA	BARAMUNDA HOUSING BOARD	Installation of 11kv LBS with DP between Baramunda housing board feeder and CRPF feeder .	0.11
5	BCCD-2	SAINIK SCHOOL	GAJAPATINAGAR	Installation of 11kv LBS with DP between Gajapati nagar feeder and press feeder.	0.11
6	BCCD-2	CS PUR-2/SAISHREE VIHAR	NAVAL	Installation of 11kv LBS with DP between Naval and BDA-1 feeder.	0.11
7	BED, BBSR	NAHARKANTA	NAHARKANTA	Installation of 11kv LBS with DP between Naharkanta feeder and Pahal feeder.	0.11
8	BED, BBSR	NAHARKANTA	BALIYANTA	Installation of 11kv LBS with DP between Baliyanta feeder and Bhingarpur feeder.	0.11
9	BED, BBSR	BHINGARPUR	GANGESWAR	Installation of 11kv LBS with DP between Gangeswar feeder and Trinath bazaar feeder.	0.11
10	BED, BBSR	PANDARA	JAGANNATH	Installation of 11kv LBS with DP between Jagannath feeder and Pandara Village feeder.	0.11
11	CED	TANGI	HARIPUR	Installation of 2 LBS with one 4 pole structure at Sandha Padia.	0.22
12	CED	GOPALPUR	42 MOUZA	Installation of 2 nos of line DP LBS from Pratapnagari Dahaliabag to Pratapnagri.	0.22
13	CDD-2	CRRI	CRRI	Installation 11kv line DP LBS at forder farm to link CRRI & Mahanadi-2 feeder(Mahanadi vihar)	0.11
14	CDD-2	JAGATPUR	NADIKULA	Installation one LBS with DP near Pepsi factory to link between Nadikula & IDCO feeder	0.11
15	CDD-2	KANDARPUR	AYETPUR	Installation a DP LBS at Andpada between Ayetpur and Ramchandrapur feeder,Kisan nagar	0.11
16	CDD-2	KISAN-NAGAR	MALLIPUR	Installation one DP LBS near for back feeding from Kishan nagar feeder(Kisan nagar)	0.11
	Total				**2.09**

Table 6-29 Proposal for Installation of Load Break Switch (B)

SL. NO.	DIVISION NAME	33/11 KV STRUCTURE NAME	11 KV FEEDER NAME	PROPOSAL	Rs Cr
17	CDD-2	KISAN-NAGAR	BISWALAPADA	Installation one DP LBS near for back feeding from Kishan nagar feeder(Kisan nagar)	0.11
18	CDD-2	BENTKAR	KALAPADA	Installation 2 nos of DP LBS for back feeding from Chanduli feeder(Bentkar structure)	0.22
19	CDD-2	BENTKAR	JHINKIRIA	Installation 2 nos of DP LBS for back feeding from Bentakar feeder(Bentakar structure)	0.22
20	CDD-2	MATAGAJPUR	MATAGAJAPUR	Installation one DP LBS near structure to backfeed from Industrial-2 feeder(OGP)	0.11
21	CDD-2	OGP	INDUSTRIAL-1	Installation one line DP LBS at Aurobind nagar(Kali mandir) to back feed this feeder from Kalyani nagar feeder(Chauliaganj)	0.11
22	CDD-2	OGP	OGP & GOSHALA	Installation one line DP LBS inside Premises of Govt. Press at Khapuria to link Industrial-1 feeder from OGP feeder	0.11
23	CDD-2	JAGATPUR-IPICOL	MAHANADI	Installation one LBS with DP to link between Nadikula feeder(Jagatpur structure) & Mahanadi feeder at Mundasahi .	0.11
24	CDD-2	JAGATPUR-IPICOL	NEW INDUSTRIAL	Installation one LBS with DP to link between IDCO feeder(Jagatpur) & New Industrial feeder(Jagatpur-IPICOL) at Coal Tar Factory .	0.11
25	CDD-2	MAHANADI VIHAR	MAHANADIVIHAR-I	Installation 400A line DP LBS near structure for backfeeding from Gandarpur feeder(Mahanadi vihar Structure)	0.11
26	CDD-2	SOMPUR	RAMKUMARPUR	Installation 400A line DP LBS near structure for backfeeding from Teldia feeder(Sompur Structure)	0.11
27	CDD-2	SOMPUR	SOMPUR 2	Installation 400A line DP LBS near structure for backfeeding from Teldia feeder(Sompur Structure)	0.11
28	CED	CHOUDWAR	OTM	Installation a line DP LBS(11KV) at Pathagara 9 pole structure for back feeding OTM feeder from Choudwar feeder.	0.11
29	CDD-2	KANDARPUR	PARAMHANSA	Installation two nos of LBS with One four pole structure at Matgajpur Nadibandha.	0.22
30	CED	CHHATISA	BANIPADA	Installation two LBS with one Four pole structure at East End Technologies Pvt Ltd	0.22
31	CED	CHHATISA	KUSPANGI	Installation two LBS with one Four pole structure at Similihand .	0.22
32	CED	CHOUDWAR	ARC	Installation 2 LBS with One four pole structure at Baidheswar Temple(Agrahat) .	0.22
	Total				**2.42**

The details of the proposals is given in

6.3.6.1 Proposal for Trolley Mounted Distribution Transformer

Brief description about the Scheme Proposed	In this scheme, TPCODL proposes use of trolley mounted Distribution Transformers, to make the process of immediate power restoration at the time of natural calamities like storms and cyclones more flexible. This will reduce the restoration time, apart from lowering the requirement of man-hours.
Capex Amount	Rs 2.31 Cr
Benefit to customer	1. Faster power restoration at time of DT failure 2. Public Safety 3. Lesser Road Congestion
Existing System in place	In current scenario, in case of Distribution Transformer failure, about 8-9 hrs. is required to complete the total process of issuing of transformer from stores, loading –unloading, use of manpower and use of crane for mounting transformer over plinth or concrete foundation. Supply interruption for this considerable amount of time leads to customer dissatisfaction apart from loss of MUs that would have been consumed.
Need of the Project/ Statutory Compliance	Mobile Distribution transformers rapidly restore electrical service. Compact and easy mobility for emergency Service, forced outage repairs, temporary service restoration and regularly scheduled maintenance. Mobile transformers are designed to withstand the road travel requirements and maximum stability and protection for safe movement over uneven pavement. Inclusion of some Portable distribution transformer will lead to: 1. Flexible and faster temporary restoration-Total time for restoration is equal to that required to move the trolley at the location and to connect the HT and LT jumpers 2. A lot of man-hours can be saved. For conventional method of replacement of failed distribution transformers, manpower is required for loading and unloading of the transformer and also to issue the transformer from stores is time consuming which

	involves a series of approvals. By use of these transformers, the time for recovery of supply is lowered down. 3. Replacement of DT in conventional method, involved road blockage which lead to disturbance for general public on road- However use of these trolley mounted portable distribution transformers, we will be able to reduce road congestion.
Proposal for the Capex investment	In this proposal, TPCODL intends to carry out new trolley mounted DSS at 10 locations on priority basis.
Cost estimate	Detailed cost estimate given below

Table 6-30 Cost Estimate for 500 kVA Trolley-mounted Distribution Substation Refurbishment

Sl. No.	Item Description	Unit	Quantity (For One)	Total Quantity	TPCODL/ CDB Rates	Cost for 10No's Trolley Mounted DSS
1	Trolley for Mounting TRF	EA	1	10	2,00,000.00	20,00,000
2	500 KVA , 11/ 0.4 KV (AL) Transformer with Tap Changer BIS Energy level II	EA	1	10	5,80,000.00	58,00,000
3	LT Distribution Box with MCCB, Aluminium Busbar for 6 Bay with kit kat fuse for 500 KVA S/S	EA	1	10	97,360.00	9,73,600
4	BOARD DANGER 11KV SIZE 8X10 INCH	EA	2	20	94.4	1,888
5	LUG AL CRIMPING 55 SQMM XLPE SINGLE HOLE	EA	3	30	12	360
6	CABLE 1.1KV AL 1X630 SQMM UNAR XLPE	M	40	400	466.24	1,86,496
7	LUG AL CRIMPING 630 SQMM XLPE ONE HOLE	EA	32	320	135.7	43,424
8	ISMC-75*40 GI Channel (7.24KG/M)	KG	170	1700	121.1	2,05,870
9	ISA-50*50*6 GI Angel (4.6KG/M)	KG	70	700	121.1	84,770
10	FLAT GI SIZE 50X6MM	KG	30	300	88.5	26,550
11	BOLT & NUT GI 16MMX75M HEX	KG	10	100	96.76	9,676
12	BOLT & NUT GI 12MMX75MM HEX	KG	5	50	96.76	4,838
13	BOLT & NUT GI 16MMX200MM HEX	KG	5	50	96.76	4,838
14	WASHER GI SIZE 12MM DIA	KG	0.5	5	118	590
15	WASHER GI SIZE 16MM DIA	KG	0.5	5	118	590
16	TEMPLETE FOR TRANSFORMER MAINT.RECORD	EA	1	10	79.65	797
17	CONNECTOR PALM LT BRASS 1000A 630KVA TRF	EA	4	40	1,349.92	53,997
18	55 SQ MM 11kV insulated conductor	M	300	3000	150	4,50,000
	3x120+1x70+1x16mm2 AB cable,	KM	1.03	10.3	4,50,000.00	46,35,000
	Aluminium Socket-120Sqmm	No	8	80	22	1,760
36	BOLT & NUT GI 12MMX50MM HEX	KG	1	10	96.76	968
						1,44,86,011
					Rs Cr	1.45
	Total cost of materials for the year 2018-19					**1,44,86,011**
	Stock, Storage & Insurance = 3% of **(A.)**					4,34,580
	Sub total					**1,49,20,591**
	T & P charges = 2% of **(B.)**					2,98,412
	Contingency = 3% of **(B.)**					4,47,618
	Transportation Charges = 7.5% of **(B.)**					11,19,044
	Erection Charges = 10% of **(B.)**					14,92,059
	Sub Total					**1,82,77,724**
	Over Head Charges = 6% of **(C.)**					10,96,663
	Total Estimated Capital Cost					**1,93,74,388**
	GST @18% of (**I**)					34,87,390
	CESS @ 1% of (**D.**)					1,93,744
	Total					**2,30,55,521**
					Rs Cr	2.31

6.3.6.2 Capex requirement of Fault Location Cell:

Following testing equipment are required in order to carry out routine activities under fault location cell.

Table 6-31: Breakup of Capex for Fault Location Cell

Sl no	Name of equipment	Qty.	Unit Price	Total Price with 18% GST (Rs Cr)	Requirement
1	LT Cable Fault Locator with pin pointer	3	₹ 30,23,000.00	₹ 1.07	For fault location on LT cables separate low voltage cable fault locators are needed. Since earth resistance at LT cable network are on higher side, Low voltage equipment are more suitable as they have higher tolerance of earth resistance. HT CFL equipment requires very low earth resistances so it is not recommended on LT cables and may result into failure of very costly HT CFL vans.
2	Murray Loop/ High Voltage Bridge	2	₹ 19,04,000.00	₹ 0.45	For dead short, cut open or moisturised cable faults HT CFL machine sometimes fails to get proper fault location due to technological limitation. In such cases Murray loop equipment can be an effective method to locate fault distance.
3	Portable Time Domain Reflectometer	3	₹ 5,97,000.00	₹ 0.21	Portable Time Domain Reflectometer are needed for phase comparisons. Many LT and few HT cable dead short/open faults can be identified with portable TDR.
4	Online route tracer	2	₹ 7,27,000.00	₹ 0.17	Route tracing is one of the important activity of FLC. This equipment would be used to identify if any live cables are present in ground before giving permit for excavation work.
	Total			₹ 1.90	

The above testing equipment will enhance the in-house capabilities of FLC team. It will also reduce the total time required for fault location, thus it would reduce cable down time and revival time.

Budgetary estimates have been taken from manufacturers/authorized dealers and mentioned as above.

6.3.6.3 CAPEX requirement for In-House Repairing of Switchgears

In TPCODL network, at present we are having Ring Main Units which delivers reliable and quality power supply to its valuable customer base mainly in Puri. Now many RMU & CSS are coming in Bhubaneswar & Cuttack city through Scrips Project. Any untimely failure of this critical power delivery asset will results in customer dissatisfaction viz. loss of revenue due to unserved energy and expenditure incurred on repair and replacement of these Switchgears.

Many switchgears in Puri were damaged during cyclone FANI which needs repair & replacement.

TPCODL wish to develop a state of art of doing in-house repairing of these switchgears through in-house developed team to take care of the various issues that generally arises during 'day in - day out' operations on these switchgears.

In near future we will propose to set up a switchgear workshop with basic in-house testing & repair facility. This will also include a fabrication workshop where various RMU covers as well as LT ACB/FPB covers will be fabricated in house.

In view of this to start with, following equipment are required in order to carry out routine activities under switchgear workshop.

Table 6-32: Breakup of Capex In House Repairing of Switchgear

Sr. no	Equipment	Qty	Unit Price	Total Price	Requirement
1	5 kV IR tester	3	3,75,000.00	11,25,000.00	To check insulation integrity IR testers would be required.
2	Contact Resistance Meter	3	1,50,000.00	4,50,000.00	To check contact resistance of breaker contacts and other contacts such as bus bar joints. Any increase in resistance will result in higher heating which increases failure of switchgears. So CRM test is important to reduce such failure.
3	CB time interval meter	3	1,75,000.00	5,25,000.00	To check open/close timing of breakers. Any change in timing will indicate problem in CB mechanism so corrective action can be taken.
4	Vacuum bottle integrity tester	3	8,25,000.00	24,75,000.00	To check leakage in vacuum bottle to prevent RMU failure
5	SF6 gas leak detector	3	1,15,000.00	3,45,000.00	To check SF6 gas leakages to prevent switchgear failure
6	SF6 gas refilling device	3	6,50,000.00	19,50,000.00	For topping up SF6 gas in switchgears
8	Ultrasound detection equipment	3	5,50,000.00	16,50,000.00	For predictive maintenance of switchgears. Any loose connection in cable compartment, abnormal discharges can be detected.
9	DC Hipot	2	12,00,000.00	24,00,000.00	For checking insulation integrity of RMU/CSS
10	Primary injection test kit	1	15,00,000.00	15,00,000.00	For checking CT ratio & relay trip settings
11	Secondary injection test kit	2	12,50,000.00	25,00,000.00	For checking relay healthiness & trip settings.
12	Tool kit	3	15,000.00	45,000.00	For maintenance job on switchgear
	Total			1,49,65,000.00	
	Total including cost escalation @10%			1,64,61,500.00	
	GST 18%			29,63,070.00	
	Grand Total			**1,94,24,570.00**	

The above equipments will enhance the in-house capabilities of switchgear team. It will also reduce the total time required for breakdown & preventive maintenance of RMU & CSS. The budgetary estimates have been consulted from manufacturers/authorized dealers and mentioned as above.

6.3.6.4 Pipe earthing

Brief description about the Scheme Proposed	Strengthening of the Earthing system in Power Distribution System
Capex Amount	Rs 0.88 Cr
Benefit to customer	1. Lesser chances of fault 2. Reliable power supply 3. Equipment safety
Existing System in place	During the site visits, it is observed that at most of the places earthing is either in damaged or not available. This is because of the depletion of the earthing electrodes or connections and such situations may pose safety threat to the human beings or animals in the form of shocks. Therefore, as a corrective measure, earthing is required to be done to ensure safety of man and material.
Need of the Project/ Statutory Compliance	The Main objectives of an earthing system are to provide an alternate path for the fault current to flow so that it will not endanger the user, maintain the voltage at any part of an electrical system at a known value and prevent excessive voltage on the equipment. As per Central Electricity Authority Regulations (Measures relating to Safety and Electric Supply,2010) rule 41, there is provision of earthing, neutral wire in a 3-phase, 4-wire system and the additional third wire in a 2- phase, 3-wire system. **Earthing-** (1) All metal supports and all reinforced and pre-stressed cement Concrete supports of overhead lines and metallic fittings attached thereto, shall be either permanently and efficiently earthed by providing a continuous earth wire and securely fastening to each pole and connecting with earth ordinarily at three points in every km with the spacing between the points being as neatly equidistant as possible or each support and the metallic fitting attached thereto shall be efficiently earthed.

	(2) Metallic bearer wire used for supporting insulated wire of overhead service lines of voltage not exceeding 650 V shall be efficiently earthed or insulated. (3) Each stay-wire shall be similarly earthed unless insulator has been placed· in it at a height not less than 3.0 metres from the ground. In an electrical installation, earthing system play important role for proper working of the power distribution system, and protection of human beings against electric shock. Metal frame of all power distribution equipment are connected with the general mass of the earth which is always at zero potential. It's worth mentioning that the general mass of the earth doesn't have any resistance. In case the earthing of any power equipment or network becomes weak or defective due to corroded connections or damaged connection, clearance of fault may take more time and putting stress on the equipment connected in the network.
Proposal for the Capex investment	In this proposal, TPCODL intends to carry out new earthing in phase manner. In this year around 1000 locations are being proposed for carrying out earthing at various locations.
Cost estimate	Detailed cost estimate attached

Table 6-33: Capex Requirement for Pipe Earthing

Sl. No	MATERIAL CODE DESCRIPTION	Qty	Unit	per unit price	Total Amount
1	Supply of GI Pipe 40MM dia 3Mtr Long	1000	EA	1,050.00	10,50,000.00
2	Installation of GI pipe along with construction of Earthing Chamber(2ftx2ft) and RCC slab cover- Scope also includes supply of necessary charcoal, salts and excavation of soil	1000	EA	2,270.00	22,70,000.00
3	Supply of FLAT(Strip GI SIZE 50X6MM.	10000	M	182.5	18,25,000.00
4	Supply of MS nut-bolt	5000	kg	78	3,90,000.00
					55,35,000.00
				Rs Crs	0.55
A.	**Total cost of materials for the year 2018-19**				**55,35,000.00**
I.	Stock, Storage & Insurance = 3% of **(A.)**				1,66,050.00
B.	**Sub total**				**57,01,050.00**
I.	T & P charges = 2% of **(B.)**				1,14,021.00
II.	Contingency = 3% of **(B.)**				1,71,031.50
III.	Transportation Charges = 7.5% of **(B.)**				4,27,578.75
IV.	Erection Charges = 10% of **(B.)**				5,70,105.00
C.	**Sub Total**				**69,83,786.25**
I.	Over Head Charges = 6% of **(C.)**				4,19,027.18
D.	**Total Estimated Capital Cost**				**74,02,813.43**
I.	GST @18% of (**I**)				13,32,506.42
II.	CESS @ 1% of (**D.**)				74,028.13
E.	**Total**				**88,09,347.98**
				Rs Crs	0.881

The details of the schemes in given in **10 Annexure .**

6.3.7 Distribution Transformer Augmentation

Brief description about the Scheme Proposed	To cater the increasing load demand, especially with the introduction of schemes like 5T and others, DT augmentation is required to avoid overloading of transformer leading to transformer failure and power interruptions.

	Also to ensure reliable power supply to our consumers, Distribution Transformers has to be kept at optimum loading so as to avoid any mechanical stress on the transformers due to overloading. When a distribution transformer loading exceeds 100% of the rated capacity of the transformer, then it is considered to be "overloaded". After capturing the loading of the Distribution Transformers, it has been observed that at several locations, especially in urban area, DTs are operating at overloaded condition. To avoid these overloading issues especially in urban areas where the load growth is high, it is required to augment the capacity of the Distribution transformers so as to mitigate the overloading issue.
Capex Amount	Rs 7.53 Cr.
Benefit to customer	1. Reliable power supply by reducing chances of fault in network, thereby reducing power interruptions 2. Reduce over-burdening of existing Distribution transformers thereby reducing power cuts.
Existing System	To cater the increasing load demand, especially with the introduction of schemes like 5T and others, DT augmentation is required to avoid overloading of transformer leading to transformer failure and power interruptions. Also to ensure reliable power supply to our consumers, Distribution Transformers has to be kept at optimum loading so as to avoid any mechanical stress on the transformers due to overloading. When a distribution transformer loading exceeds 100% of the rated capacity of the transformer, then it is considered to be "overloaded". After capturing the loading of the Distribution Transformers, it has been observed that at several locations, especially in urban area, DTs are operating at overloaded condition. To avoid these overloading issues especially in urban areas where the load growth is high, it is required to augment the capacity of the Distribution transformers so as to mitigate the overloading issue
Need of the Project	In case of overloading of the Distribution Transformer, it not only hampers the power supply to the consumers but also may cause pre-mature failure of DT due to operating for long hours on overload condition. Thus to abide by the safe loading limits, augmentation of

	distribution transformers are proposed for locations, where loading is exceeding the maximum value.
Proposal for the Capex investment	In this proposal, TPCODL intends to carry out Distribution Transformer's augmentation for those DTs which are identified as overloaded based on the peak load served. Total 103 Transformers are proposed for Augmentation out of which 25 no.s 500 KVA and 78 no.s 250 KVA DTs are at different locations.
Cost Estimate	Detailed Cost Estimate of the Work is given below

Table 6-34 : BOQ for Augmentation of Distribution Transformer to 250/500KVA

Sl. No.	Item-Description	Unit	Qty.	Rate	Total Price
1	2	3	4	5	6
1	250KVA, 11/0.4KV, Al, Transformer with tap changer , BIS energy level-II	EA	78	268450	20939100
2	500KVA, 11/0.4KV, Cu, Transformer with tap changer , BIS energy level-II	EA	25	580000	14500000
3	LT Distribution Box with MCCB, Aluminium Bus bar for 3bay with kit-kat fuse for 250KVA S/S	EA	78	48000	3744000
4	LT Distribution Box with MCCB, Aluminium Bus bar for 6bay with kit-kat fuse for 500KVA S/S	EA	25	97360	2434000
5	1Cx400 sqmm LT cables XLPE (Armour) for 250KVA S/s	MTR	4680	479	2241720
	1XC 400sqmm LT cables XLPE (armoured) for 500KVA s/s	MTR	3000	479	1437000
6	11kv LA, 12KV 10KA	EA	309	3550	1096950
7	Plinth foundation for Transformer	EA	78	18000	1404000
8	40mm dia GI pipe earthing device 3 mtr. Long	EA	412	1050	432600
8	GI Flat for Earthing 50x6	KG	2060	75	154500
8	Material for masonary work for Earth pit, charcoal, salt,etc including construction of earthing chamber size (2'X2') and RCC slab cover	KG	412	2270	935240
A	GRAND TOTAL(1 to 8)				**4,93,19,110**
B	Stock & Storage @ 3% of A				14,79,573
C	Sub - Total (A+B)				5,07,98,683
D	Contingency @ 3 %+T&P Charges @2%+Transportation 7.5% +Erection 5%=17.5 % of C				88,89,770
E	Sub - Total (C+D)				5,96,88,453
F	Other Overheads including supervision charges @ 6% of E				35,81,307
G	Total estimated Capital Cost (E+F)				6,32,69,760
H	GST 18% of G				1,13,88,557
I	CESS 1% of G				6,32,698
J	**Total Cost**				**7,52,91,014**

6.4 Load Growth

6.4.1 Meter Installation for all new connection

Load growth in a system is a natural phenomenon and is the outcome of increase in number of connections and addition of new load by existing customers. Taking reference from past two years, it is expected that approximately 50 K new connections would be applied in FY 21 - 22. In order to meet this load growth, network infrastructure needs to be strengthened, and new energy meters need to be installed to release the new connection.

Following table enumerates the requirement of the new energy meters and accessories which are envisaged against new connection in different load segments. This does not include network augmentation, if required, for release of the connections.

Below table shows the requirement of meters as envisaged for release of the new connections and the associate costs of Meters alone.

Table 6-35 : Requirement of Energy Meters and costs to meet Load Growth

Meter	Meters (Count)	Cost per unit (Rs)	Rate of Meter Installation (Rs)	Cost of Material (Cr)	Cost of Installation (Cr)	Total Amount (Cr)
Single Phase	50000	701.23	387.30	3.51	1.94	5.44
Single Phase SMART	0	3862.70	387.30	0.00	0.00	0.00
Poly Phase	0	0.00	0.00	0.00	0.00	0.00
Poly Phase SMART	0	6916.65	483.35	0.00	0.00	0.00
LTCT	0	0.00	0.00	0.00	0.00	0.00
LTCT SMART	500	4827.76	1342.90	0.17	0.07	0.24
HTCT -11kV/110V	300	3800.00	1342.90	0.11	0.04	0.15
HTCT -33kV/110V	100	3800.00	1547.62	0.04	0.02	0.05
Interface Meter	0	61317.52	1261.29	0.00	0.00	0.00
Net Meter- Single Phase	500	1504.50	430.05	0.08	0.02	0.10
Net Meter- Poly Phase	100	3170.28	430.05	0.03	0.00	0.04
Net Meter - LTCT	100	5000.00	1597.17	0.05	0.02	0.07
Net Meter- HTCT	50	6172.58	1612.99	0.03	0.01	0.04
Grand total	51650			4.01	2.11	**6.12**

For installation of Energy Meters, Meter box will also be installed to protect the meters and avoid the possibility of energy theft. Further, suitable size of the service cable to extend the supply to the consumer premises has also been considered. Seven different rating of service cable are considered in the plan according to the load demand and connection category.

Further, accessories like Modems, Bus bar and Distribution Boxes are required to extend the supply and to take energy readings from remote.

This table shows the requirement of meters box with cost of supply for LT meters and HT meters CT PT unit cost with meter box and installation cost

Table 6-36 : Requirement of Meter Boxes and costs

Boxes	Meter Box (Count)	Cost per Unit (Rs)	Cost (Cr)
Single phase	50500	98.54	0.50
Single phase SMART	0	250.00	0.00
Poly Phase	0	600.00	0.00
LTCT	500	5829.34	0.29
CTPT unit 11KV (includes Installation)	350	41754.30	1.46
CTPT unit 33 KV (includes Installation)	100	65888.30	0.66
Total	51450		2.91

This table elaborates the quantity of cables required for installation of new connections.

Table 6-37 : Requirement of Cable and costs

Cable Size (Core * Sq mm)	Cable length - KM	Cost per unit (Rs)	Rate of installation (Rs)	Cost of Mat (Cr)	Cost of Inst (Cr)	Total Cost (Rs CR)
2*4	875	36.48	650.00	3.19	2.28	5.47
2*10	450	54.50	700.00	2.45	1.05	3.50
4*10	0	69.27	950.00	0.00	0.33	0.33
4*25	0	127.00	950.00	0.00	0.14	0.14
4*95	21.6	340.50	1850.05	0.74	0.11	0.85
4*150	14.4	523.10	2004.29	0.75	0.08	0.83
10*2	0	0.00	0	0.00		0.00
Grand Total				7.13	3.99	11.12

Cost of Accessories which will be required for installation of the meters where defective meters are to be replaced.

Table 6-38 Cost of Accessories

Accessories	Accessories (Count)	Cost per unit (Rs)	Rate of Installation per unit (Rs)	Material Cost (Cr)	Installation Cost (Cr)	Total Cost
Modem	0	4262.00	232.22	0.00	0.00	0.00
Bus Bar -Single Phase	10000	1020.00	284.42	1.02	0.28	1.30
Bus Bar -Three Phase	8000	1225.00	342.98	0.98	0.27	1.25
Bus Bar -LT Distribution	2000	1275.00	342.98	0.26	0.07	0.32
Poly carbonate seals	380325	4.54	0.00	0.17	0.00	0.17
Cell Phone for AMR Work	40	10000.00	0.00	0.04	0.00	0.04
Extending of RAPDRP Terminals for AMR Analysis (Including Installation)	50	50000.00	0.00	0.25	0.00	0.25
Stationary and it printing (Meter Change Sheet, JSA booklet etc)	1	100000.00		0.01	0	0.01
Total				2.73	0.63	3.36

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Therefore, in FY 21-22, it is planned to install approx.60 Thousand new energy meters (other than Smart meters) under load growth category and feeder meter installation category. Accordingly CAPEX investment of Rs **23.47 Cr** is planned for providing new connections and feeder meter installation.

6.4.2 New Connection

Scheme Proposed	Taking reference from past two years, it is expected that approximately 65K – 75K new connections would be applied in FY 21 - 22. In order to meet this load growth, both network infrastructure needs to be strengthened, 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. For carrying out network extension/ augmentation/addition, we propose expenditure to the tune of Rs 20 Crores under this head. To consider load growth, network extension / augmentation / addition is expected to be carried out to cater the new demand.
Capex Amount	Rs 20 Cr.

Benefit to customer	Better the availability of materials, faster will be process of providing new connection hence more will be the customer satisfaction

6.4.3 Addition / Augmentation of Power Transformers

Brief description about the Scheme Proposed	To cater the increasing load demand, especially with the introduction of schemes like 5T and others, PTR augmentation is required to avoid any overloading and N-1 fail situations. Also to ensure reliable power supply to our consumers, PTRs has 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, TPCODL has undertaken the assessment of the loading of the power transformers and found that to meet the estimated summer'22 load, it is required to augment some of the power transformers in Bhubaneswar and Cuttack city area which may get overloaded considering the current peak and load growth for the next two years. To carry out the detailed Study of the PTR, inputs were collected from field such as Existing log sheet data for 24 months from each 33/11 kV substations. Then we analyzed the loading pattern & fixed the load growth for next 2 years for all divisions. While superimposing the future loading pattern on the existing network we found that some of the Power Transformers may get overloaded and the present capacity of transformers will not suffice the N-1 criteria. Hence based on the survey reports and discussion with the field teams, few proposals have been identified where we need to augment the Power transformers to have trouble free summer. To mitigate the same, various proposals are put forth for approval where we have considered: 1. Power Transformer augmentation 2. New Transformer addition 3. Load shifting from one transformer to other transformer within the substation

Capex Amount	Rs 15.25 Cr.
Benefit to customer	1. Reliable power supply by ensuring N-1 reliability at PTR level 2. Reduce over-burdening of existing PTRs thereby reducing power cuts.

Table 6-39 Details of Addition/ Augmentation of Power Transformers

Sl. No	Division	Structure name	PTR Name	Proposals	Budget (In Cr)
1	BCDD-1	Unit-VI	PTR-1	Augmentation of existing 33/11kV 5MVA Power Transformer-1 to 12.5MVA at Unit -6 power substation in BCDD-1 to mitigate N-1 fail condition keeping in view of exigency of SCRIPS load .	2.11
2	BCDD-1	Unit-IV	PTR-1	Augmentation of existing 33/11kV 5MVA Power Transformer-1 to 12.5MVA at Unit -4 power substation in BCDD-1 for mitigating overload and N-1 issue and keeping in view of exigency of SCRIPS load.	4.4
3	BCDD-1	Unit-IV	PTR-2	Augmentation of existing 33/11kV Power transformer-2 from 5MVA to 12.5MVA at Unit -4 power substation in BCDD-1 for mitigating overload and N-1 issue and keeping in view of exigency of SCRIPS load	
4	BCDD-2	Nayapalli	PTR-1	Augmentation of existing 33/11kV 8MVA both Power Transformer-1 to 12.5MVA, Providing bus-section between existing PTR-2 and existing PTR-3 at Nayapalli power substation in BCDD-2 To help mitigating overloading on PTR1 and N-1 fail condition on power transformer through load shifting via 11kv bus section.	2.24
5	BCDD-2	C S Pur -I	PTR-1	Augmentation of existing 33/11kV Power Transformers 1 to 12.5MVA respectively to mitigate overload and N-1 fail. Providing bus-section between existing PTR-1 and PTR-3 at CS pur-1 power substation in BCDD-2.	4.38
6	BCDD-2	C S Pur -I	PTR-3	Augmentation of existing 33/11kV Power Transformers 3 to 12.5MVA respectively to mitigate overload and N-1 fail.	
7	BCDD-2	Kanan vihar	PTR-2	Augmentation of existing 33/11kV Power Transformers- 2 from 8MVA to 12.5MVA to mitigate overload and N-1 fail in Kanan-vihar power substation of BCDD-2 and Load transfer to proposed 33/11kv Shaileshsree Vihar Structure.	2.12
	Total				**15.25**

6.5 Infrastructure Development

In this head, all expenditure related to technology adoption and strengthening of various offices and establishment of Call centre, data centre etc. have been considered. Presently, customers are interacting through very few available media for resolution of their issues and queries.

6.5.1 Call Centre & Customer Care centre:

Call Centre and Customer care Centre facilities needs to be developed as existing facilities are inadequate.

- Previously, only one call centre with 4 lines was available for handling both commercial and supply related calls from all consumer of TPCODL- which often deprived most of our customer from getting there complaint registered and subsequently followed by dissatisfaction. Further, Customer interaction at Customer care centre / Division / Sub-division / Section lacks basic amenities and require renovation / re-vamping to make it convenient for customers.

- Many of the Customer Service Centres are being re-strengthened in this Financial Year. However this is not adequate enough to cater our customer base of 2.7 millions covering a geographical area of 29,000 sq Kms belonging to diversified segments, to meet their expectation and respond accordingly. – Thus considering our current amenities it has been planned to establish call centre and customer care centre in each of the sections in our TPCODL licensed area, which totals to a number of 257 and the estimated cost is as mentioned below.

Major Category	Activity	Tentative Amount (in Crs)
Infrastructure & Development	Infrastructure for Customer Care cum Payment collection Centre at each Section Office	5

6.5.2 IT and technology for process efficiency and enhanced productivity:

The basic IT Framework is being set up in FY20-21, which covers, centralized and integrated Core IT applications including ERP, MBC &CIS and Business Intelligence for all consumers, employees, management and offices.

In FY 21-22, the Major focus is on making the Network more robust, theft free and more secured. For the same, it is required to implement latest & updated versions of Firewall, Antivirus, eMail Spam protection systems & Back up systems for critical applications. Further, there is a plan for setting up Locational Network , for which Switches, Routers, UPS supply &

Wifi devices will be required. To improve the communication network between Bhubaneswar & Cuttack , there is Plan of Fiber Connectivity between the two cities.

Table 6-40 Expenditure on IT and technology

Sr No	Activities	Capex Requirement
A	Cyber Security Initiatives	8.76
B	Location network	8.16
C	Printers	1.55
D	User Devices	5.13
E	DR servers	0
F	Reporting solution	7.5
G	Communication	3.00
H	Software	4.308
	Total	**38.41**

- **Detailed Expenditure Plan (FY 22)**

The breakup of the expenditure given in **Table 6-40 Expenditure on IT and technology** is given as under

Table 6-41 Expenditure on IT and technology

IT Infra DPR - 2021 - 2022			
Cyber Security Initiatives			
Item Description	**Unit Cost (Cr.)**	**Quantity**	**Amount (Cr.)**
Backup System (Enterprise Applications)	1.48	1	1.48
Backup System (End User Devices) 2000 Laptop / Desktop + Email Archival	4.06	1	4.06
Gateway Firewall	1.07	1	1.07
Email SPAM Protection	1	1	1
Internet Proxy Security	1	1	1
Antivirus Security -1000 devices	0.15	1	0.15
Total Amount (A)			**8.76**
Locational Network			
Item Description	**Unit Cost (INR)**	**Quantity**	**Amount (INR)**
24 port network Switch	2,80,000	125	3.5
Enterprise Router with 2 WAN ports	1,60,000	125	2
Wi-Fi Devices with controller	20,000	200	0.4
Internet Router - CISCO ASR	10,00,000	2	0.2
UPS 3 KVA for switch	1,65,000	125	2.0625
Total Amount (B)			**8.1625**
Printers			
Item Description	**Unit Cost**	**Estimated Nos**	**Amount (Crs.)**
Type 1 Printer (Network)	2,75,000	40	1.1
Type 2 Printer (Desktop)	55,000	50	0.275
Type 3 Printer (Thermal)	35,500	50	0.1775
Total Amount (C)			**1.5525**

User Devices			
Item	**Unit Cost**	**Estimated Nos.**	**Amount (Crs.)**
Laptop / User Device	70000	500	3.5
Desktop / User Device	52000	300	1.56
Type 1 UPS for Desktop	3200	75	0.024
Type 2 UPS for Desktop	5700	75	0.04275
Total Amount (D)			**5.12675**
Total Amount (E)			**0**
Reporting Solution			
Item Description	**Unit Cost**	**Estimated Nos.**	**Amount (Crs.)**
SAP HANA for BW	65000000	1	6.5
Implementation	10000000	1	1
Total Amount (F)			**7.5**
Communication			
Item Description	**Unit Cost**	**Estimated Nos.**	**Amount (Crs.)**
Fiber connectivity implementation of Bhuwaneshar & Cuttak offices	30000000	Lumshum	3
Total Amount (G)			**3**
Software			
Item Description	**Unit Cost**	**Estimated Nos.**	**Amount (Crs.)**
MS office	24000	1000	2.4
Remote Support solution (Anydesk / Teamviwer)	4000	2000	0.8
Implementation of warehouse management system	10000000	1	1
Adobe Professional	36000	30	0.108
Total Amount (H)			**4.308**

6.5.3 Implementation of GIS Road Map

This has been explained under the “Schemes with a Road Map”

6.5.4 Setting up of Transformer Repair Workshop

At present, there are approximately 650 numbers of operational 33/11KV power transformers of capacity from 1 MVA to 12.5 MVA installed at 290 numbers of 33/11KV primary substations. Nearly 70 number of substations are under construction and expected to be commissioned by June 2021. Number of power transformer accordingly will increase following the commissioning of new 33/11KV primary substations.

Similarly there are nearly 70,000 numbers of operational 11/0.415KV distribution transformers of capacity varying from 10KVA to 990KVA across TPCODL area. Besides, there are few 33/0.415KV, distribution transformers installed at 33/11KV primary substations. The

number of distribution transformers are also expected to grow further due to increase in power demand. The failure rate of transformers for the past 5 years is given as under;

The failure rate of DTs is more than 5% & Power Transformer failure rate is 1.5% .Further, nearly 114 number of power transformers and 3000 numbers of distribution transformers are stored at Choudwar and Power House stores. Many of these transformers are stored for more than 4 years and their health condition is yet not known.

Whenever the power and distribution transformers develop faults and being declared fault after testing at Site, the transformers are removed from service and sent to registered agencies for reconditioning / repair. The repair & Tarnsport cost is high for small repairing work, the transformers are sent to the agencies.

In view of above constraints, and in order to ensure availability of power and distribution transformers, to optimize the expenditure on reconditioning/refurbishment of transformer, and to improve the quality of reconditioning / refurbishment, it is proposed to establish a transformer repair workshop at Choudwar, Cuttack. This workshop will be established in one of the shed earmarked for the purpose. Lot of space is available near this shed for storage of failed, and repaired transformers. The transformers workshop will serve the following purposes

a) Testing of power and distribution transformers available in stores to assess their health,
b) Reconditioning of transformers available in stores whose health condition found bad,
c) Overhauling/reconditioning of transformers identified by section/E&MR during maintenance,
d) Replacement of winding by cannibalizing,
e) Minor repairing of transformers at workshop and site,
f) Reconditioning of transformers at workshop and site,
g) Painting of transformers at workshop and site,
h) Oil filtration at workshop and site
i) Keeping records of transformers inventory across TPCODL including their movement, and retirement,
j) Organizing the transformer workshop and transformer store yards,
k) Upkeeping of transformers workshop,
l) Identification of transformers which needs to be sent to agencies for repair,
m) Monitoring of transformer repair jobs at agency works, stage and final inspection, and issue of dispatch instructions,
n) Analysis of failures, Establishment of corrective actions, Establishment of KPIs, Establishment of Baseline data and future targets, Maintaining records,

o) Submission of monthly reports to management.

6.5.5 Store Dept- Capex Requirement

1-CIVIL WORK-Choudwar, Bhubaneswar, Janla, Khurda, Banarlpal store and Jagat Pur, Badambadi scrap store.(Rs.4.7 Cr.)

(a) Concrete Flooring ,choudwar and Bhubaneswar Store
(b) Pukka flooring in Janla, Banarlpal and Khurda store.
(c) Pukka flooring in Jagatpur and Badambadi scrap store.
(d) New Shed required in Choudwar, Janla, Banarpal and Bhubaneswar Store.
(e) Racking System required in all above store shed.
(f) Employees setting office, washroom and pantry required in all above mention stores
(g) Security Room required in all above mention stores.
(h) New Boundary Wall, renovation of boundary Wall, heighten and Main Gate required for all above mention store.
(i) Safety equipment required in Khurda, binaural and Badambadi store.

2-HIGH MAST- 2 Nos. Banarlpal, 2Nos, Khurda Store and 01 No. Badambadi scrap store. (Rs 0.3 Crores)

6.5.6 Civil Infrastructure:

Several activities has been planned to improve the current conditions of our store, repair workshop, seating arrangement and others .Presently there is no infrastructure for closed door repair and maintenance of Transformer in our area of operation. To facilitate /augment transformer repairs it is desired to have in house repairing of transformers. The concept behind Hands on Technical training centre(HOTT) infrastructure is to impart training to BA employees with bright guidance adhering to all safety parameters. Prototype of field experience is imparted. To utilize additional floor above existing building, it is proposed to create additional seating space by constructing additional floor on the existing building so that the offices currently in rented space can be shifted. At present section offices are in dilapidated condition. Refurbishment of the same is essential as maximum footfall is observed at the sections. Also it has been observed that all incoming and outgoing electrical equipment are stored haphazardly on uneven muddy ground and in submerged conditions in monsoons, which reduces the life cycle of equipment. Hence it is proposed to have raised platform for neatly and segregated stacking. The furniture available at offices is nearly 10- 15 years old and is in non-serviceable condition. New furniture are to be procured for various offices, Customer Care Centres, etc. and also to cater to new incoming employees.

Details of Scheme Proposed	Transformer repair workshop renovation, Constructing of +1 structure, Section Office ,Platforms at Stores, buying of furniture
Capex Amount	Rs 14.8
Benefit to customer	1. Improved working environment for comfort of customer and employees, Open office culture 2. Enhanced consumer interaction, safety of consumer & equipment 3. Improved document storage.

- Field Surveys has led to requirement of plinth fencing for DSSs to ensure safety and abide by all statutory rules and compound wall construction of GSSs. For submerged low lying areas like Sakhigopal and Pipili, area development is one of the major need. The break-up of a total amount of Rs 4.5 Crs for these safety and statutory activities are as mentioned in the table.

- To ensure safe, hygienic, well ventilated and spacious working environment for employees as well as consumers, a capital expenditure of approx. INR 3.5 Cr is proposed for section offices, under Infrastructure and Development.

- Also other activities under Infrastructure and Development are, construction of proper transformer workshop to replace the currently existing old ones to ensure proper working amenities and environment thereby ensuring maximum engagement from our staff.
- An amount of Rs 4.05 Crs is considered for building +1 structures so as to ensure maximum utilization of our property and increase our employee sitting capacity. Rs 1 Cr is proposed for platform at stores, Rs 1.75 Cr for Training Centres and Rs 2.5 Cr for furniture.

  The detailed break-up of cost with each activity is as given below:

Table 6-42: Capex breakup of Civil Infrastructure Upgradation

Major Category	Activity	Tentative Amount (in Crs)
Infrastructure and Development	Transformer repair workshop	2
	Training (HOT) Centre @ 5 Circle (05 no X 0.35 Cr)	1.75
	Constructing of +1 structure (15 no X 0.27 Cr)	4.05
	Section Office (100 no X 0.035 Cr)	3.5
	Platforms at Stores	1
	Furniture (650 Seating X 0.030 Cr)	2.5
	Total	**14.8**

6.5.7 Administration Dept- Capex Requirement

In TPCODL, The office space is currently crowded and lacks proper seating plan. Moreover, most of the movement area has been occupied with files, documents etc

Some of offices are owned and others are on rented property.

One of the challenges existing in TPCODL in using current buildings and infrastructure is to accommodate more employees in already existing property and providing a hygienic, well ventilated and spacious working environment to our colleagues.

In FY 2020-21, we have renovated many parts of our existing offices, which included shifting of old files and shelves – thereby increasing the floor area and also using proper seating arrangement in a planned manner.

With the objective to provide best in class services to consumers, earn consumer delight, and improve satisfaction among other stakeholders and maintaining a clean & safe working environment, following infrastructures are required at work place:

- Office air conditioning systems are required to provide a comfortable working environment to bring and control Energy Efficiency, Humidity, Air Quality, and Reduction in Noise & Keeping Business Critical Equipment at the Right Temperature. Also stabilizers are advised along with A.Cs so as to avoid voltage fluctuations.

- Considering the fact that the state of Orissa is one of the most humid states of our country, Water cooler & R.O Water Purifiers are required for proper hydration employees and to ensure good health and improve overall efficiency.

- Most of the chairs currently existing in our office are wooden, which is not the best option to be considered from ergonomic point of view. That is why, ergonomic office chairs are designed for sitting long periods with ease. This naturally helps employees work more efficiently and productively. Another benefit is reduction in healthcare expenses related to poor posture from unsuitable office chairs. Already replacement have been made in few of our offices.

- Photocopier machines to offer a fast and easy way of getting single or multiple copies of documents & Improves Functionality of businesses.

- Canteen facilities are the necessity of satisfying employees with a better range of foods and healthy options. Workplace canteens need to provide with options to cater for lunch with meals or light breakfast items and fruit or snacks for mid-afternoon along with tea/ cold drinks/ coffee in order to promote healthy eating & refreshments for employees and stakeholders so as to ensure maximum focus of employees on their work without worrying about their meals.

To facilitate smooth operation and support hygiene and conducive work environment, TPCODL proposes **Rs 2.24 Cr**. under Admin head to support various departments / locations.

Table 6-43:Capital Expenditure for Administration in various offices

APPROX. QUANTITY FOR ADMIN IN VARIOUS OFFICES REQUIREMENT (FY 21-22)				
COMMODITY↓	**COUNT (OFFICES)→**	**TOTAL ITEM WISE**	**VALUE PER UNIT IN (Rs.)**	**TOTAL VALUE (Rs.)**
AIR-CONDITIONER with stabilizers	QTY. (PER OFF.)	300	₹ 39,000.00	₹ 1,17,00,000.00
WATER COOLER	QTY. (PER OFF.)	75	₹ 40,000.00	₹ 30,00,000.00
R.O. WATER PURIFIER	QTY. (PER OFF.)	75	₹ 13,000.00	₹ 9,75,000.00
CHAIRS	QTY. (PER OFF.)	500	₹ 7,500.00	₹ 37,50,000.00
PHOTOCOPIER	QTY. (PER OFF.)	10	₹ 1,00,000.00	₹ 10,00,000.00
OFFICE TABLE	QTY. (PER OFF.)	100	₹ 10,000.00	₹ 10,00,000.00
CANTEEN/PANTRY (LUMPSUMP)	QTY. (PER OFF.)			₹ 10,00,000.00
TOTAL				**₹ 2,24,25,000.00**

7 Annexures A :

7.1 Reference Table 2-8: Data Creation and Data Porting Services

8 Annexure B

8.1 Reference 6.3.4-33KV System Improvement Schemes for feeders & Power Evacuation Scheme from OPTCL Grid

9 Annexure C-

9.1 Reference 6.3.5-33KV System Improvement schemes - Equipment like 33KV RMU

10 Annexure D

10.1 Reference 6.3.6 11KV System Improvement schemes – Feeders & Equipment like AB Switch, RMU, Load break switch, ACB & MCCB

11 Annexure E

11.1 Reference 6.4.3 Addition / Augmentation of Power Transformers