March 04, 2022
File No TPCODL/Regulatory /2022/31/1752

Secretary
Odisha Electricity Regulatory Commission
Bidyut Niyamak Bhawan
Plot No 4, Chunokoli
Shailashree Vihar
Bhubaneshwar 751021

Dear Sir

Sub: Petition for Approval of the Capital Investment Plan for FY 2022-23

We are through this letter submitting a petition to the Hon'ble Commission for approval of the Capital Investment Plan for the FY 2022-23. We request you to kindly approve the same.

We trust our submissions are in order

Yours faithfully

(Vidyadhar H Wagle)
Head Regulations

TP CENTRAL ODISHA DISTRIBUTION LIMITED
(A Tata Power and Odisha Government Joint Venture)
Corporate Office: Power Square, Unit-VIII, Bhubaneswar – 751012
Registered Office: IDCO Towers, 2nd Floor, Janpath, Bhubaneswar – 751022 Tel.: 0674 2541575
Web: www.tpcentralodisha.com, E-mail : tpcodl@tpcentralodhisa.com, CIN : U40100OR2020PLC032901

BEFORE THE ODISHA ELECTRICITY REGULATORY COMMISSION,
BIDYUT NIYAMAK BHAWAN.
PLOT No-4, CHUNOKOLI, SHAILASHREE VIHAR, BHUBANESWAR-751021

Case No:_____/2022

IN THE MATTER OF: Application for approval of Capital Investment Plan for the FY 2022-23 in the Licensed Area of TP Central Odisha Distribution Ltd.

And

IN THE MATTER OF: TP Central Odisha Distribution Ltd. (Formerly CESU), Corporate Office, Power House, Unit 8, Bhubaneswar- 751 012 represented by its Chief – Regulatory & Government Affairs.

…. Petitioner

IN THE MATTER OF: All Concerned Stakeholders.

…. Respondents

Affidavit

I, Puneet Munjal, aged about 58 son of late Jagdish Lal Munjal residing at Bhubaneswar do hereby solemnly affirm and say as follows:

1. I am the Chief-Regulatory & Government Affairs of TP Central Odisha Distribution Ltd., the Petitioner in the above matter and I am duly authorized to swear this affidavit on its behalf.
2. The statements made in the submission -File No- TPCODL/Regulatory/2022/ 31/ 1752 herein shown to me are based on information provided to me and I believe them to be true.

Bhubaneswar.
Dated: 04.03.2022

Chief-Regulatory & Government Affairs

BEFORE THE ODISHA ELECTRICITY REGULATORY COMMISSION,
BIDYUT NIYAMAK BHAWAN.
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…. Applicant

IN THE MATTER OF: All Concerned Stake Holders.

…. Respondents

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 regulations. 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 2020 in July 2020. The Hon'ble Commission in its order dated 8th September 2020 in the said matter approved Capex of Rs. 280.63 Cr against our submission of Rs.344.44 Cr. The Capital Expenditure for FY 2020-21 is under progress in TPCODL. The Status of the capital expenditure under this approval is explained in this submission.

Further ,TPCODL has submitted DPR for implementation of Geographic Information System (GIS) over a period of 3 Years and implementation of Smart Metering System over a period of 4 Years for the approval of the Hon'ble Commission. The Hon'ble Commission in its Order dated 4th Sep 2021 has approved Rs. 52.79 Cr against the GIS DPR and Rs. 86.73 Cr against the Smart meter DPR (including the Rs.15.36 Cr approved in the Hon'ble 's Order dated 08.09.2020).Out of the total approved DPR amount of Rs.86.73 Cr for Smart Meter Projects ,an amount of Rs. 47.6 Cr was approved for FY 2021-22 and out of the total approved DPR amount of Rs. 52.79 Cr for GIS project, an amount of Rs.17.32 Cr was approved for FY 2021-22.

Thereafter, TPCODL submitted its Capex Investment plan for FY 2021-22 in January 2021 before the Hon'ble Commission for approval. The Hon'ble Commission has in its order dated 18.09.2021 in the matter of Case 05 /2021 approved Capex of Rs.298.73 Cr against our submission of Rs.567.98 Cr.

The approved amount of Rs.298.73 Cr includes the amount approved for FY-2021- 22 against the GIS (Rs.17.32 Cr) and Smart Meter DPR(Rs.47.6 Cr) as mentioned above. The Status of the schemes approved in the said order is explained in this submission.

We are in this submission filing the proposal for Capital Investment for FY 2022-23 for the approval of the Hon'ble Commission. We are also seeking an approval of the Hon'ble Commission to permit carrying forward of the capital expenditure approved for FY 2020-21 to FY 2022-23 and Capex approved for FY 2021-22 to FY 2022-23.

The details of the various schemes are given in the following paragraphs.

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1 Capital Investment/Expenditure Proposal for FY 2022-23

1.1. Need for Capital Expenditure

TPCODL receives electrical power at 33KV level from 51 numbers of 220/33KV or 132/33KV transmission substations 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. Further, 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. The 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 other challenges related to 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 and also in the petition filed in Case 05 of 2021 for FY 2021-22.

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 and FY 2021-22 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. In addition to the same, TPCODL has proposed

fresh schemes for implementation. Viz (f) Schemes with a Theme for improving Bhubaneshwar city reliability and improving the voltages in various areas , g) Unforeseen Capex

In this regard it is submitted out of the expenditure proposed for schemes FY 2022-23, TPCODL has considered four schemes which have a Road Map i.e where the investment is spread over more than one year. Such schemes have been approved by the Hon'ble Commission in the past and they include a) Smart Meter Implementation b) SCADA Implementation c) Implementation of GIS and d) Augmentation of Communication Network. In the Capital Expenditure for FY 2022-23, TPCODL has considered the contribution of such schemes too.

The summary of the Capex planned for FY 2022-23 (only Hard Cost i.e without considering Employee Costs capitalized and Interest During Construction) is as summarized below

Table 1 Expenditure Proposal Summary for FY 2022-23 (Hard Cost)

Sr No	Capex Head	Activity planned	OERC Approved Road Map Scheme (DPR Amount)	Scheme Value (Rs. Cr)	Capex in FY 2022-23	Capitalization in FY 2022-23
A	**Safety & Statutory**	Load Forecasting Software as a part of compliance to DSM guidelines		0.15	0.15	
		Procurement of Safety gadgets and equipment		5.05	5.05	
		Construction of training institute for TPCODL		1.5	1.5	
		Unsafe to Safe Locations - Interposing Poles		5	5	
		Test Lab development at various MMG Divisions		0.49	0.49	
		Boundary Wall/ FRP Fencing/ Construction of Plinth		3.5	3.5	
		Stores - Water hydrant system & Intrusion Detection System		2	2	
		Testing instrument for STS		2.5	2.5	
		Sub Total		**20.19**	**20.19**	
B	**Loss reduction**	Replacement of LT Bare Conductor with LT AB Cable (720 Ckt KM)		20	20	
		Defective Cable Replacement		11	11	
		Procurement for Mobile Phone & Blue Tooth Printer for new Upcoming SHG & TPCODL staff		1.25	1.25	
		Cable for installation of DT Meter (4.46 Crs) and Feeder Meter Installation (3.86 Crs)		8.32	8.32	
		Smart Meter (Road map Scheme,DPR approved in Order 4th Sep 2021)	86.73	23.55	23.55	
		SAP AMI license for AMI Deployment		10	10	
		Sub Total	**86.73**	**74.12**	**74.12**	
C	**Reliability**	GSAS : SCADA enablement of conventional substation Electronic Earthing System	129	23	23	
		Strengthening of Substation Automation Infrastructure, Deployment of New SCADA System to Setup MCC & BCC (Already Approved)		5	5	
		GSAS Automation - STS (PSS equipment replacement)		10	10	
		33KV Network Infrastructure (New Feeder, Feeder Augmentation, Feeder sectionalization, N-1 for 33KV Consumer etc)		18	18	
		Sick Equipment replacement (33KV & 11KV)		5	5	
		11KV Network Infrastructure (New Feeder, Feeder Augmentation, Feeder sectionalization, N-1 for 11KV Industrial area, 11KV B/C at Industrial PSS, 11KV AB switch etc)		20	20	
		AR, FPI, RMU, MCCB 160A, MCCB 500A		15	15	
		33KV Feeder refurbishment		7	7	
		FLC & Switchgear Workshop Equipment		7	7	
		Earthing		1.8	1.8	
		Mobile DT		1	1	
		Sub Total	**129.00**	**112.80**	**112.80**	
D	**Load Growth**	Network augmentation / addition to meet load growth		10	10	
		Power Transformer Addition / Augmentation		10	10	
		DT Augmentation		5	5	
		Sub Total		**25.00**	**25.00**	
E	**Infrastructure**	PSCC Infrastructure		0.06	0.06	
		Technology Centre		15.4	15.4	
		IT infrastructure		11.5	11.5	
		IT - Communication	49.46	2.7	2.7	
		GIS (Road map Scheme,DPR approved in Order 4th Sep 2021)	52.79	33	33	
		Civil		13.49	13.49	
		Transformer Repair Workshop Equipment		1	1	
		Ready to use office assets (Furniture & Fixture)		1.5	1.5	
		Sub Total	**102.25**	**78.65**	**78.65**	
F		**Unforeseen**		**20.00**	**20.00**	
G	Theme based proposal	Bhubaneswar Reliability Plan		100	100	
		Low voltage in Urban area		287	50	
		Sub Total		**387**	**150**	
		Final Total	**317.98**	**717.76**	**480.76**	

Note: As can be seen, the capital expenditure of Rs 480.76 Crores proposed to be undertaken also includes expenditure on account of Schemes that have been commenced under the earlier approvals of the Hon'ble

Commission. It also comprises part of the expenditure proposed to be carried out in two years viz FY 2022-23 and FY 2023-24 towards the addressing Low Voltage areas

1.3. Description of Schemes

1.3.1. Schemes that have been commenced and being continued in FY 2022-23 ("Schemes with a Road Map").

There are four schemes under this Head viz a) GIS Implementation b) Implementation of Smart Metering System c) Implementation of SCADA System and d) Installation of new communication system.

Table 2 Expenditure on Road Map Schemes of the past (Hard Cost)

Sr No	Scheme	Scheme Value (Rs Cr)	Amount to be incurred for FY 2022-23 (Rs Cr)
1	GIS Implemenation	52.79	33
2	Implemenation of Smart Metering System	86.73	23.55
3	Implemenation of SCADA system	129	23
4	Installation of New Communication System	49.46	2.7
Total		**317.98**	**82.25**

The explanation to the above schemes have been provided in our submission to the previous petitions and the same have not been repeated as the expenditure for the same has been approved in the previous orders of the Hon'ble Commission.

1.3.2. Theme Based Schemes

There are two schemes proposed to be taken up under this head. The expenditure under the two schemes is as follows:

Table 3 Expenditure on Theme Based Schemes

Sr No	Scheme	Scheme Value (Rs Cr)	Amount to be incurred for FY 2022-23 (Rs Cr)
1	Bhubaneswar Reliability Plan	100	100
2	Low voltage in Urban area	287	50
Total		**387**	**150**

The brief description to the Schemes is as given below

1.3.2.1. Bhubaneswar Reliability Plan

To ensure 24x7 reliable power supply to each consumer of BBSR city area, the Company has identified a number of challenges related to Safety, 33KV/11KV/0.415KV network, civil infrastructure and climate change. These challenges are planned to be addressed through a systematic investment plan by the Company to maintain 24x7 power supply in the BBSR City area. The proposed Capex plan is apart from that has been submitted so far and has been approved by the Hon'ble Commission under Capex FY 2020-21 & FY 2021-22. This represents a justified and efficient level of total capital investment estimated by the Company to meet the service obligation; improving safety, reliability of network, improve the level of service standards.

To maintain 24x7 reliable power supply, a need is also felt to improve the existing facilities and infrastructure to provide a better consumer experience and a modern, rich, and conducive work environment to the workforce for better performance. In line with this, installation of LT protection at DSS, replacement of defunct AB switches, installation of 11KV Breaker at O/G feeder from PSS (wherever required), provision of 11KV Bus coupler, PTR upgradation & interconnector between PSS or DSS to maintain ring are the various identified proposals which would be covered under this scheme. Substantial investment is required to achieve 24x7 power supply reliability to the consumers of Bhubaneswar City. However, investing such a huge amount in a year will put an additional burden on the tariff and therefore, it is proposed to carry out the expenditure for network improvement in phased manner in next 4-5 years with an aim to address the key area in first phase and other area in subsequent phases.

Table 4 Phasing of Expenditure under Bhubaneshwar Reliability Plan

Sl. No	Activities Proposed	Total estimated Cost (Rs Cr)	FY 22 - 23 (in Cr)	FY 23 - 24 (in Cr)	FY 24 - 25 and beyond (Rs Cr)
1	33KV New network for improving the Reliability	125	24.81	69.15	31.04
2	Installation of 33kV RMU in network for removing T-OFF	65.57	7.56	22	36.01
3	Provision of 33kV Bus coupler at 33/11KV PSS.	7.53	4.99	2.54	0
4	Improvement in PTR N-1 redundancy at PSS	47.88	8.91	15	23.97
5	Improvement in 11kV feeder reliability	228.72	36.86	75	116.86
6	Refurbishment of DSS for improving reliability & ensuring safe operation / LT DB Installation	58.26	17.23	19	22.03
7	Enhancement of Safety & Reliability through Installation of Interposing poles, Feeder Pillar / Services Pillar etc.	6.98	0	3	3.98
	Total	**539.94**	**100.36**	**202.69**	**233.89**

The investment under this head for FY 2022-23 is proposed at **Rs 100.36 Crores**. The Detailed DPR on the subject is given in **Annexure 1- 24 x 7 Power Supply to Bhubaneshwar**

1.3.2.2. DPR for Network strengthening to address low voltage issues in Urban Area

As per CEA guidelines, Voltage variation limit for 33kV is defined as +6% and -9% of the reference voltage. TPCODL has carried out the 33KV network study through load flow software to understand how power flows around the electrical network and what are the deficiencies which need to be attended to ensure reliable and Quality power supply to the consumers.

As an outcome of the Study, it is observed that 117 nos Primary Substation are operating at a voltage below the permissible voltage band of (-) 9% and hence require some mitigation solution to address the low voltage issues. The reason for this voltage drop is a) due to improper conductor size being used in the feeder, b) overloading of feeder and c) PSS are commissioned at a long distance from OPTCL Grid substation. The Company has evaluated the various mitigation solutions and found that the voltage issues can be addressed by implementing different proposals like Conductor augmentation, new feeder, NOP change, New Grid Substation, TAP change of the 33/11KV Power Transformers etc. On the basis on the evaluation, it is observed that following proposals categories wise will suffice the low voltage issues at 33KV level. Each type of proposal will help in mitigating the low voltage issues at PSS level.

Apart from the above identified solutions, few areas identified where there is a requirement of new 33/11KV Primary substation to improve the voltage profile. Network studies for all such areas evaluated that by constructing new 33/11 KV Primary substations at these 12 nos locations, Voltage can be improved. With an objective of addressing all low voltage pockets by March ’24, a comprehensive DPR has been prepared for Rs 287 crore and planned for implementation in two years span i.e. in FY2022- 23 and FY 2023- 24.

Table 5 Expenditure under Low Voltage Mitigation Schemes

Sr No	Activities Descriptions	Qty	Unit	Cost in Cr
1	Construction of 33/11KV PSS	11	No's	240.04
2	Conductor Augmentation in Km	105	KM	15.77
3	Construction of new Line	95	KM	32
	Total Cost in Cr			287.81

The details of the scheme, the various areas the projected improvements is given in **Annexure 2- Mitigation of Low Voltage in Areas.** Out of this an expenditure of **Rs 50 Crores** is planned for **FY 2022-23**

1.3.3. Schemes proposed to be completed in one year i.e FY 2022-23

There are several scheme that are being proposed in various identified areas. The description of the Schemes has been provided in **Annexure 3 – Schemes proposed to be completed within a year**

Table 6 :Schemes proposed to be completed in one year

Sr No	Scheme	Scheme Value (Rs Cr)	Amount to be incurred for FY 2022-23 (Rs Cr)
1	Safety & Statutory	20.19	20.19
2	Loss reduction	50.57	50.57
3	Reliability	89.80	89.80
4	Load Growth	25.00	25.00
5	Infrastructure	42.95	42.95
Total		**228.51**	**228.51**

1.3.4. Unforeseen 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

- **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 has a lead time of 6 to 8 months. In approved capex FY 2020 - 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.

- **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 wished 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.

- **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 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 also the fund requirement.

Keeping the above situation in mind, we have proposed n amount of **Rs 20.00 Crores** is proposed for the FY 2022-23 under this head of "Un foreseen Expenditure"

1.4. Status of Capex and Capitalization against Capex approved by the Hon'ble Commission for FY 2020-21 and FY 2021-22

The Hon'ble Commission has approved Capex of Rs.280.63 Cr for FY 2020-21 in its order dated 08.09.2021. For FY 2021-22, the Hon'ble Commission has approved a Capex of Rs.298.73 Cr in its order dated 18.09.2021.The status of project progress against the Capex approved for FY 2020-21 and FY 2021-22 is as provided in table below.

Table: Actual Status as on 31.01.2022 against Capex approved for FY -21 & FY-22 (Rs Cr)

Sr No	Major Category	Out of FY-21 approved Capex			Out of FY-22 approved Capex			Out of FY-21+FY-22 Approved Capex		
		Approved for FY-21	Total Capex till Jan'22	Total Capitalization till Jan'22	Approved for FY-22	Total Capex till Jan'22	Total Capitalization till Jan'22	Total Approved (FY-21+FY-22)	Total Capex till Jan'22	Total Capitalization till Jan'22
		A	B	C	D	E	F	G=A+D	H=B+E	I=C+F
1	Statutory , Safety & Security	68.17	44.44	31.78	17.59	1.42	0.32	85.76	45.86	32.10
2	Loss Reduction	39.63	13.94	9.25	67.36	7.73	2.32	106.99	21.67	11.57
3	Reliability	72.48	43.05	35.76	114.42	22.92	9.24	186.90	65.96	45.00
4	Load Growth	9.00	1.40	0.00	30.52	5.64	4.60	39.52	7.04	4.60
5	Technology & Infrastructure	91.35	67.27	66.41	68.84	1.55	0.27	160.19	68.81	66.68
	Total	280.63	170.09	143.20	298.73	39.25	16.75	579.36	209.34	159.95

For Scheme wise Project Progress Status as on 31.01.2022 against Capex approved for FY 2020-21 and FY 2021-22 , we have provided the same in **Annexures 4 and Annexure 5**

1.5. Employee Costs and Interest During Construction 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 it is very difficult to identify the employees and their costs to be included for capitalization. Hence TPCODL has not provided any estimate in the petition for the same. However we wish to submit that

the cost towards Employees working on such projects would be separate i.e in addition to the amount that is approved by the Hon'ble Commission under this petition.

Similarly, the Interest During Construction (IDC) is required to be worked out on the Debt Component (70%) of the Capex. The same would depend on the quantum of the capital expenditure spread during the year and hence the estimation has not been made at present in this petition. However we wish to submit that Interest During Construction amount would need to be added in addition to Hard Cost and Employee Cost to be capitalised.

1.6. Summary of the Capital Expenditure (Hard Cost) in FY 2022-23

Based on the above, the capital expenditure for FY 2022-23 is as follows:

Table: Summary of Capital Expenditure for FY 2022-23

Sr No	Area of Expenditure	Schemes under Road Map - approved earlier by Hon'ble Commision		Schemes under Road Map - New Schemes proposed in petition		Year Expenditure Schemes		Capex in FY 2022-23
		Scheme Value	Capex in FY 2022-23	Scheme Value	Capex in FY 2022-23	Scheme Value	Capex in FY 2022-23	
1	Safety & Statutory		0	0	0	20.19	20.19	20.19
2	Loss reduction	86.73	23.55	0	0.00	50.57	50.57	74.12
3	Reliability	129	23	0	0.00	89.8	89.8	112.8
4	Load Growth	0	0.00	0	0.00	25	25	25
5	Infrastructure	102	35.7	0	0	42.95	42.95	78.65
6	Unforeseen					20	20	20
7	Theme based proposal			387	150			150
Total			**82.25**		**150**		**248.51**	**480.76**

1.7. Comparison with Capital Expenditure envisaged under Vesting Order

The vesting order dated 26th May 2020 had stipulated minimum capital expenditure as follows:

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 904 Crores upto 31st March 2023. As compared to the same, based on the submissions and projections in this petition, the expected performance of TPCODL till the end of FY 2022-23 is more than the target as provided in the Vesting Order as follows:

Table 7 :Capital Expenditure from 1st June 2020 to 31st March 2023

Sr No	Particulars	Capex
1	Cumulative Capex committed till FY 2022-23	904
2	Capital Expenditure approved in FY 2020-21	280.63
3	Capital Expenditure approved in FY 2021-22	298.73
4	Capital Expenditure proposed for FY 2022-23	481.46
5= sum (2:4)	**Total upto 31st March 2023**	**1060.82**

1.8. Prayers to the Hon'ble Commission

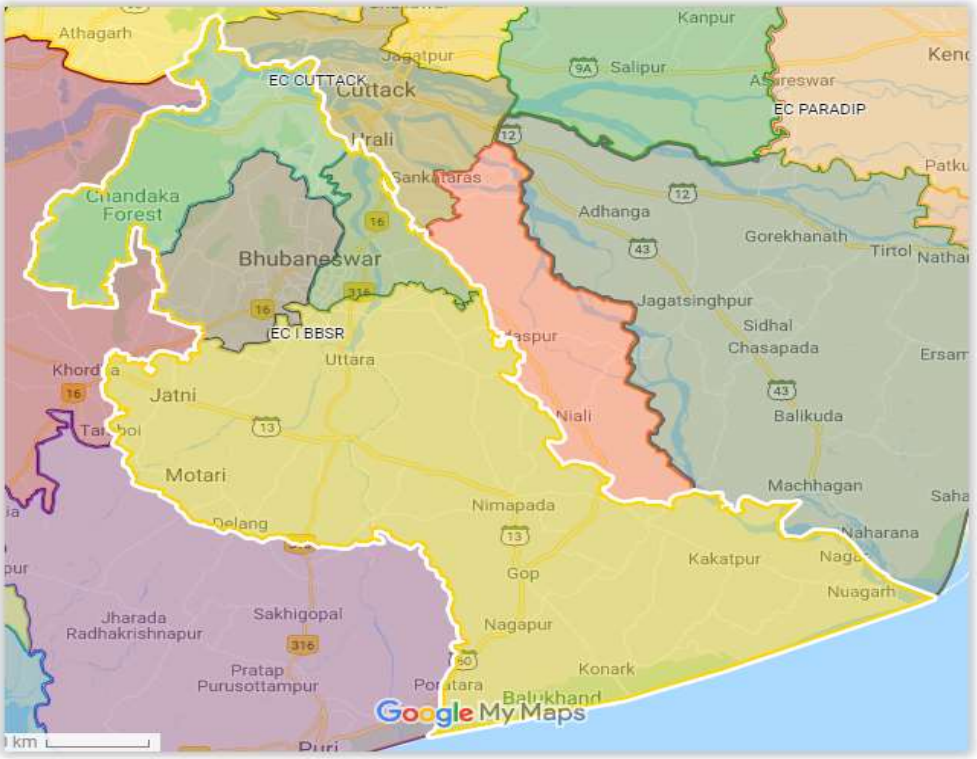
TPCODL prays the following to the Hon'ble Commission

i. Approve the Capital Expenditure plan and breakup as proposed in **Table 1 Expenditure Proposal Summary for FY 2022-23 (Hard Cost)** for the FY 2022-23 on account this capital expenditure
ii. Approve the carry forward of the capital expenditure of the schemes approved in the FY 2020-21 and FY 2021-22
iii. Allow Employee Cost and Interest During Construction based on actuals to be capitalised over and above the amount of Costs as shown in **Table 1**
iv. Any other direction as the Hon'ble Commission may think appropriate

2 Annexure 1- 24 x 7 Power Supply to Bhubaneshwar

24X7 Power supply to Bhubaneswar

City Area



2.1 Introduction to Bhubaneshwar City Distribution

Bhubaneswar, which is a part of Bhubaneshwar -1 Circle, is the capital city of Odisha state and is a part of Khordha district. Bhubaneswar – 1 circle spreads over the geography of 2183 sq.km and from operations point of view is divided into four divisions BCDD – I, BCDD – II, BED & NED. The total consumer base of Bhubaneswar circle is 4.89 lacs at different voltage levels. HT – 832 nos. and remaining are LT consumers under various consumer category. In FY 2020 – 21, the total input energy to Bhubaneswar – I Circle was 2076 MUs and Billed Energy was 1748 MUs. The AT&C loss is 17.65% with billing efficiency 84.2% and collection efficiency of 97.8%. The various statistics of Bhubaneshwar – I is as given below:

Table 8 : Monitoring and Operation of Bhubaneshwar

Circle	No. of Division in City Area	No. of Sub Division in City Area	No. of Sections in City Area	Fuse Call Centre in city Area
BBSR-I	3	8	38	49

Further, Bhubaneswar – 1 Circle is getting supply from nine nos. 132/33kV OPTCL grid. Out of these nine no. grids, presently seven no. grids are optimally loaded and only Konark grid has single 132kV source. 62 nos. 33/11kV primary substations are feeding power supply to various parts of BBSR – I circle including Nimapara with a peak demand of approx. 397MW. Including recently charged ODSSP PSS. Total 55 nos. of 33kV feeders with an approx. length of 710 Ckm is feeding the divisions comprising of BCDD – I, BCDD – II, BED & NED Division. Total 284 nos. 11kV feeders with an approx. length of 4314Ckm are there with a population of approx. 13000+ Distribution Transformers to cater to the load demand at various voltage levels of BBSR-I Circle. One of the major challenges is the dilapidated network inherited from erstwhile CESU. The 33kV and 11kV feeders are mostly overhead, radial and lengthy having undersize, uneven sized and worn out conductors. The LV circuits are also very long and radial.

In this report, we are mainly focusing on Bhubaneswar city area (comprising three out of the four division i.e. BCDD-I, BCDD-II and BED) and all study is limited to the network infrastructure of Bhubaneswar city area.

2.2 Existing Supply System

As mentioned BBSR city area comprises electrical division namely BCDD-I, BCDD-II & BED that receives electrical power supply at 33kV level from seven numbers of 220/33kV or 132/33kV transmission substation located within and in the vicinity of Bhubaneswar city area. The consumers are getting power at supply voltage starting from 33kV till 230V depending on the demand of the consumers.

1. Operational structure

At present, there are 44 numbers of 33kV feeders with a combined circuit length of approximately 516 Ckms supplying power to 47 numbers of 33/11kV Primary Substation (Structures). The total peak load of BBSR City is 369 MVA (332MW). The 33kV supply is stepped down to 11kV level through 108 numbers of 33/11kV power transformers with an installed capacity of 942.2MVA at these primary substations. Nearly 235 numbers of 11kV feeders emanate from the 33/11kV primary substations having cumulative length of approximately 2277.96 Ckms and supply power to HT consumers connected at 11kV level and other LT customers connected to 11/0.415kV distribution substation. Approx. 8663 numbers of distribution transformers are installed in three electrical Division (BCDD-I, BCDD-II & BED). The length of the LT network is approximately 6448kms. These LT feeders supply power to three phase and single phase LT consumers. The network statistics of all three divisions are given below:

Table 9 Statistics of Bhubaneswar

Division Name	Total No. of PSS	Installed Capacity in MVA	Peak Load in MVA	Total No. of 11KV Feeders	Total No. of DT	Total No. of Consumers
BCDD-I	10	211.5	70.5	67	1521	48807
BCDD-II	22	399.7	175.7	100	3512	154198
BED	15	331	122.8	68	3630	71122
Total	**47**	**942.2**	**369.0**	**235**	**8663**	**274127**

SCADA has been implemented for 30 Nos. 33/11kV primary substations in Bhubaneswar City (BCDD-I – 9nos., BCDD-II – 13nos., BED – 8nos.) under RAPDRP schemes. In Capex 20 – 21, all the 30nos. PSS are planned to be integrated with the SCADA so that these PSS can be remotely monitored and controlled from Power System Control Centre located at Bhubaneswar.

Note- Recently additional PSS & lines are charged under Govt. ODSSP scheme & excluded from the study .

2.3 Key Challenges

TPCODL has taken over the assets of erstwhile CESU on “as is where is” basis. These assets are not in good operating condition and in a large number of cases; the required safety / protective equipment are not in place. Further, the network is in poor condition and not following the standard network design. Due to this and poor maintenance, large number of trippings are occurring in the network causing interruptions to the consumers.

Since takeover, major thrust was on mass maintenance and condition-based maintenance in 33kV network to be undertaken so that causes of tripping can be reduced which in turn will help in improving the reliability.

A. 33 KV Feeders

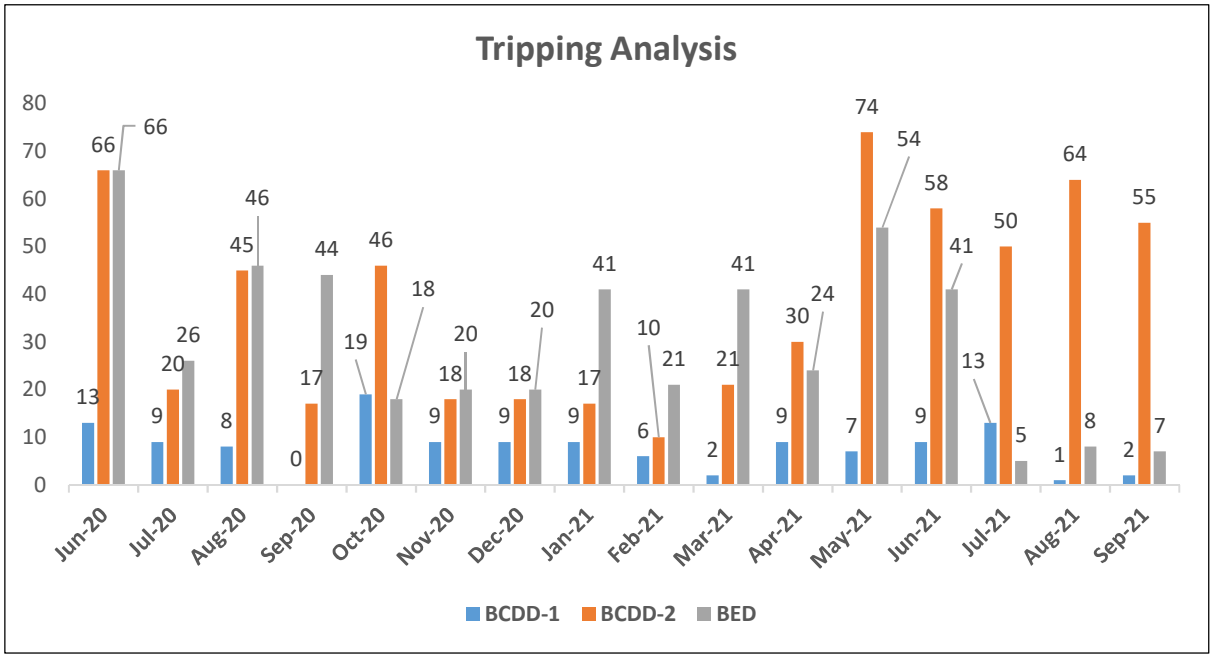
2.3.1 Poor 33kV Network Infrastructure

33kV feeders are the main power link between Transmission Grid Substation (GSS) and TPCODL Primary Substation (PSS) and provide power supply to other 33kV HT consumers. The existing 33kV network has following issues:

- Many feeders have conductor of different sizes used in different phases, which restricts the circuit capacity limiting to the lowest size of the conductor used in the circuit. This leads to overloading of the feeder, low voltage issues and higher technical losses.9% of the 33kV feeders are either overloaded or approaching overload limits.
- Many of the feeders have binding wire / multiple joints in a single span. As a result, there are chances of snapping of conductors and consequent electrocution of human beings / animals since cradle guards are not provide in required locations. These joints are also major source of technical (I^2R) losses.
- Many of the 33kV feeders are passing through dense vegetation and forestland leading to high frequency of transient faults.
- Feeders have many unprotected branches leading to tripping of entire feeder in case of fault in any feeder section.
- LILO arrangement is missing in the network design philosophy in order to arrest tripping at local level.
- Poor relay coordination between GSS and PSS causes uncoordinated tripping’s.
- Sick equipment and bypassed protection system exist in system at many places.
- Houses / structures are constructed below 33kV, 11kV and LV overhead feeders at many locations both in urban and rural areas.

- No intermediate double pole is used in 33kV feeders for mechanical strength and for conductor jointing. These H-poles are essential to avoid cascading effect of failure of poles during any disaster.
- Large number of interruptions were reported on 33kV feeders during erstwhile CESU time. However, after taking over by TPCODL, the trippings have significantly reduced through proper preventive and condition based maintenance approach. However, there is scope for further improvement to ensure reliable and quality power supply to the end users.
- The trend over a period of time is as given below:

Figure 1 : Tripping Analysis of Bhubaneshwar Network



In this regard, a study was carried out to assess the performance of various equipments[1] and based on the same several observations were made and the statistics noted.

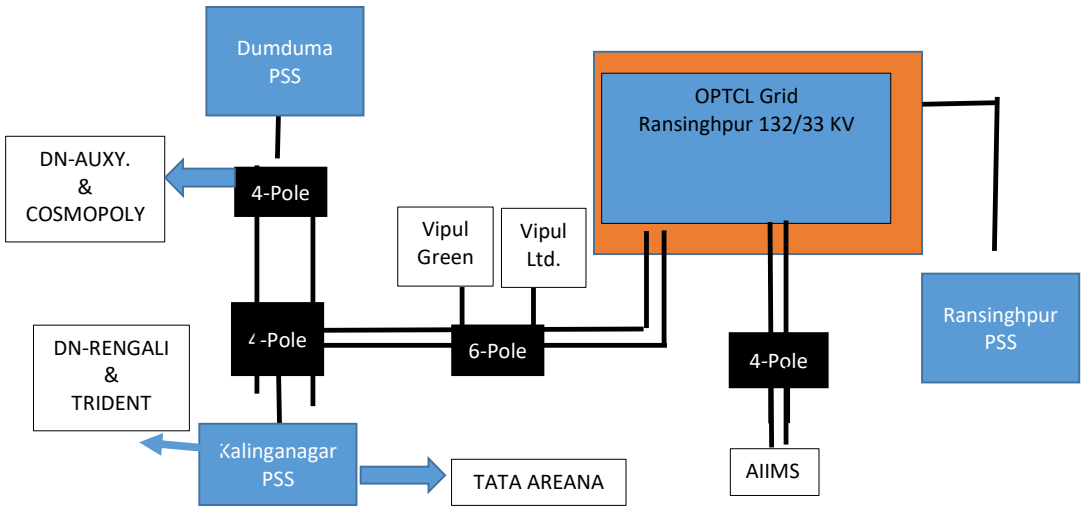
2.3.2 33kV Radial Network

Most of the 33kV networks are radial and highly unreliable. A major drawback of a radial distribution system is that in case of permanent fault, power supply failure is experienced by all consumers as there is no alternate feeder to feed consumers. An Illustration is given in

[1] The statistics quoted in this report are on the basis of a) No of 33 KV Feeders- 44 b) No Power Transformers – 108 and c) No of Substations - 47

the table below:

Figure 2 : Radial feed from OPTCL



2.3.3 N-1 issue in 33kV Feeder

There are very few 33/11kV primary substations with second 33kV source connectivity. However, during exigencies, the second source is unable to take entire load of PSS due to overloading. The reason of overloading is mainly attributable to lower conductor size in the feeder, poor circuit configuration, and lower size bus bar used at PSS and interconnecting points. Out of the 44No's of feeders nearly 54% of the feeders failed N-1 redundancy. The feeders which do not have the N-1 contingency is as follows:

Table 10 List of feeders without N-1 Redundancy

Sl. No.	Circle	Division	OPTCL Grid	33kV Feeder Name	Type (Rural/ Urban/ Industrial)	N-1 Status	Peak Loading (In MVA)
1	BBSR-1	BCDD-2	CHANDAKA GRID	BARANGA	RURAL	FAIL	7.2
2	BBSR-1	BCDD-2	CHANDAKA GRID	CHANDRASEKHARPUR-1	URBAN	FAIL	13.03
3	BBSR-1	BCDD-2	CHANDAKA GRID	CHANDRASEKHARPUR-2	URBAN	FAIL	17.49
4	BBSR-1	BCDD-2	CHANDAKA GRID	INFOCITY	URBAN	FAIL	13.71
5	BBSR-1	BCDD-2	CHANDAKA GRID	KIIT	URBAN	FAIL	4.69
6	BBSR-1	BCDD-2	CHANDAKA GRID	NARAJ	RURAL	FAIL	6.97
7	BBSR-1	BCDD-2	CHANDAKA GRID	NAYAPALLI	URBAN	FAIL	18.91
8	BBSR-1	BCDD-2	CHANDAKA GRID	SJ DEVELOPER	URBAN	FAIL	3.43
9	BBSR-1	BCDD-2	CHANDAKA GRID	TCS	URBAN	FAIL	1.03
10	BBSR-1	BCDD-2	CHANDAKA GRID	XAVIER	URBAN	FAIL	26.8
11	BBSR-1	BED	Kesura Grid	LINGIPUR	URBAN	FAIL	10.63
12	BBSR-1	BED	Kesura Grid	SBI.COLONY	URBAN	FAIL	0
13	BBSR-1	BCDD-2	MANCHESWAR -A	FDR-1 (SAINIK SCHOOL)	URBAN	FAIL	25.03
14	BBSR-1	BCDD-2	MANCHESWAR -A	FDR-10(VANI VIHAR)	URBAN	FAIL	4.06
15	BBSR-1	BED	MANCHESWAR -A	FDR-6 (LAXMISAGAR)	URBAN	FAIL	18.29
16	BBSR-1	BED	MANCHESWAR -A	FDR-7 (NAHARKANTA)	URBAN	FAIL	7.37
17	BBSR-1	BED	PHULNAKHARA	BHINGARPUR	RURAL	FAIL	3.37
18	BBSR-1	BCDD-2	RANASINGHPUR GRID	ASOTECH	URBAN	FAIL	9.14
19	BBSR-1	BCDD-2	RANASINGHPUR GRID	BARAMUNDA	URBAN	FAIL	21.71
20	BBSR-1	BED	RANASINGHPUR GRID	BHIMATANGI - I	URBAN	FAIL	24
21	BBSR-1	BED	RANASINGHPUR GRID	BHIMATANGI - II / BARAGARH	URBAN	FAIL	24
22	BBSR-1	BCDD-2	RANASINGHPUR GRID	NAYAPALLI	URBAN	FAIL	18.91
23	BBSR-1	BCDD-2	RANASINGHPUR GRID	RANASINGHPUR	URBAN	FAIL	8
24	BBSR-1	BCDD-2	RANASINGHPUR GRID	VIPUL	URBAN	FAIL	18.29

2.3.4 Double circuit 33kV Feeders are on Single Structure

Most of the 33kV feeders in Bhubaneswar city are constructed as double circuit on single structure like NBLS/H Pole/Joist Pole. In case of work on any of the circuit for attending maintenance / break down, the second source is required to be switched off for safe working. This gives unnecessary outage to consumers connected on the healthy feeders.

The existing design also does not have adequate safety clearances to work near live feeder. Out of the 44No's of feeder there are 26nos. feeders are running with double circuit configuration on NBLS Tower / H Pole / Joist pole arrangement. Approximately 60% feeders are running as double circuit on single structure as shown in the table below:

Table 11 Double Circuit feeders on Single Structure

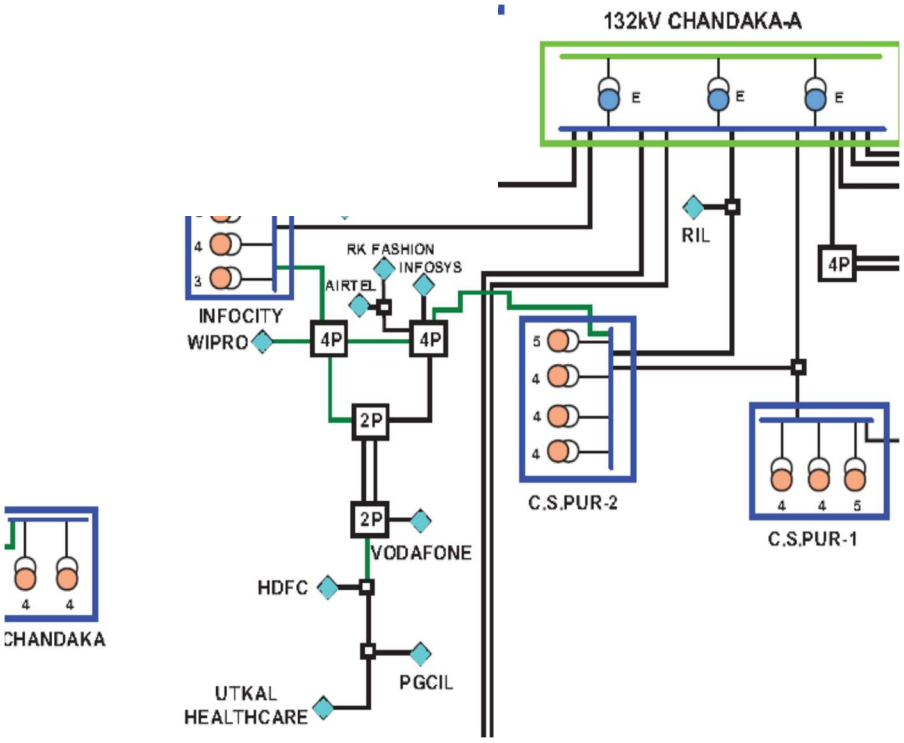
Sl. No.	Grid	33kV Circuit 1	33kV Circuit 2	Remarks
1	Mancheswar-A	FDR-1 (SAINIK SCHOOL)	FDR-2 (KHARABELA NAGAR)	Both the feeder On same NBLS
2	Mancheswar-A	FDR-3 (SHAHEED NAGAR)	FDR-4(RASULGARH)	Both the feeder On same NBLS
3	Mancheswar-A	FDR-5 (INDUSTRIAL)	FDR-6 (LAXMISAGAR)	Both the feeder On same NBLS
4	Mancheswar-A	FDR-8(RAILWAY)	FDR-9(RAILWAY)	Both the feeder On same NBLS
5	Chandaka-A	UNIT-8 FDR-1	UNIT-8 FDR-2	Both the feeder On same NBLS
6	Chandaka-A	XAVIER	NAYAPALLI	Both the feeder On same NBLS
7	Chandaka-A	CHANDRASEKHARPUR-1	CHANDRASEKHARPUR-2	Both the feeder On same NBLS
8	Chandaka-A	SJ	Barang	Both the feeder on same Hpole/RSJ
9	Ransinghpur	BARAMUNDA	NAYAPALLI	Both the feeder On same NBLS
10	Ransinghpur	BHIMATANGI - I	BHIMATANGI - II / BARAGARH	Both the feeder On same NBLS
11	Ransinghpur	Vipul	Assotech	Both the feeder On same NBLS
12	Kesura	LAXMISAGAR (FDR-I)	LAXMISAGAR (FDR-II)	Both the feeder On same NBLS
13	Unit-8	UNIT-6 GIS-1	UNIT-6 GIS-2	Both the feeder On same NBLS

2.3.5 T-OFF Network

There are many 33kV feeders feeding 33/11kV PSS along with some 33kV HT consumers. All these PSS and HT consumer power supply are tapped directly from the trunk section of the feeder through either DP / 4Pole / 6pole without any circuit breaker / HT protection arrangement.

In the eventuality of fault in any of the branch, the feeder is tripped at OPTCL grid end and all the consumers feeding from the feeder experience power supply failure, until such time, the faulty section is identified and isolated. Time duration for identification of fault is very high since it requires physical inspection of complete feeder. Sometimes, for normal changeover operation wherever dual source is available at 4 Pole / 6 Pole structure, shutdown down of both the feeders is required to operate isolators / AB switches and they cannot be operated under load condition. The whole changeover process takes long time even for a small operation.

Figure 3 :Illustration of T-Off network



There are a total of 146 Nos. of T-off's in the network that are for releasing power supply to 33/11kV PSS (62 Nos) & HT consumers (78 Nos). Out of these 78nos. HT consumers (33 KV), 63 No consumers are connected through T-off arrangement. The statistics of T-Off network is as follows:

Table 12 Statistics for T- Off Network

City	Total No of 33kV HT Consumer	Total No of T-OFF	No of Consumer connected through T -OFF	% of cases Consumer connected through T -OFF
BBSR	78	146	63	80%

At this point of time, in this report, it is planned to address the T-Offs related to 33 KV/11 KV PSS

2.3.6 33kV consumers connected without HT Protection

There are 78nos. of 33kV HT consumers connected to 33kV feeder through T-off circuits with only Horn Gap (HG) fuse protection on the DT primary side. It has been observed that their equipment are either bypassed or not properly designed and maintained. Excessive vegetation growth is observed within customer premises near power distribution facilities.

There is no TPCODL RMU or switchgear provided at customer premises to operate in case of fault / issues in customer equipment. These results in undue tripping of main breaker installed at TPCODL primary substation or OPTCL grid substation during fault in customer equipment. All customers connected to the same feeder thus experience power supply outage. These non-standard arrangements are causing power supply reliability concerns.

B. 33 KV Primary Substation

2.3.7 Primary substation with single 33kV source

Out of 47No's of PSS nearly 44% of PSS have only one 33kV incoming source, which is a major concern for maintaining reliable power supply in the city of BBSR. In ideal scenario, there must be at least two nos. of 33 kV sources available to each PSS, so that in case if any source fails, other source can restore full or partial load.

Table 13 Primary Substation with Single 33 KV Source

Sl. No.	CIRCLE	Division	Name of 33/11kV PSS	Installed Capacity (In MVA)	Firm Capacity (in MVA)	Loading (in MVA)
1	BBSR-I	BCDD-1	AIRPORT	25	12.5	3.9
2	BBSR-I	BCDD-2	BHARATPUR	21	13	12.1
3	BBSR-I	BED	BHINGARPUR	10	5	3.6
4	BBSR-I	BED	CHAKEISIANI	10	5	0.5
5	BBSR-I	BCDD-2	CHANDAKA ODSSP	16	8	3.66
6	BBSR-I	BCDD-1	DELTA	16	8	7.5
7	BBSR-I	BCDD-2	DUMDUMA ODSSP	16	8	12.45
8	BBSR-I	BCDD-2	ESI	3.2	1.6	0.47
9	BBSR-I	BCDD-2	GOTHAPATNA	16	8	3.54
10	BBSR-I	BCDD-2	KALARAHANGA	8	0	4.53
11	BBSR-I	BCDD-2	KANANVIHAR	20.5	8	13.2
12	BBSR-I	BED	MANCHESWAR	33	20.5	15.5
13	BBSR-I	BED	MULAPADIA	16	8	8.3
14	BBSR-I	BED	NAHARKANTA	16	8	9.3
15	BBSR-I	BED	PANDARA	16	8	6.9
16	BBSR-I	BCDD-2	RANASINGHPUR	10	5	3.71
17	BBSR-I	BCDD-2	RRL ODSSP	10	5	4.5
18	BBSR-I	BCDD-1	SATYANAGAR	16	8	6.8
19	BBSR-I	BED	SBI KESURA	8	0	1.9
20	BBSR-I	BCDD-1	UNIT-2	16	8	7.9
21	BBSR-I	BCDD-2	XAVIER	25	12.5	5.53

2.3.8 Primary substation without 33kV Bus coupler

Most of the PSS in TPCODL are having single bus bar without 33kV bus coupler arrangement. 33kV bus with bus coupler arrangement allows higher flexibility in operations. If any PSS with two power transformers is designed with two different 33kV sources; both power transformers can operate from two different sources, based on the load margin availability keeping the bus coupler in open state. In this scenario, if any source goes out there will be partial shutdown the consumer and by closing the bus coupler, power supply can be restored to the affected consumers within a short time. The two sources can also be operated in parallel for ensuring highest reliability.

The major disadvantage of continuous bus arrangement is; even though the PSS has two nos. 33kV feeder source, it allows operating the entire PSS with single 33kV source due to technical limitation and second 33kV source remains in stand-by state. In the event of tripping of main source, the second source will be closed to restore power supply. Almost 77% of existing PSS are designed with continuous 33kV bus arrangement without bus coupler. The PSS identified without a Bus Coupler is provided in the table below:

Table 14 Primary Substation without a Bus coupler

Sl. No.	Circle	Division	PSS Name
1	BBSR-1	BCDD-1	Board Colony
2	BBSR-1	BCDD-1	AIRPORT
3	BBSR-1	BCDD-1	DELTA
4	BBSR-1	BCDD-1	UNIT 2
5	BBSR-1	BCDD-1	UNIT-3
6	BBSR-1	BCDD-1	UNIT-4
7	BBSR-1	BCDD-1	SATYA NAGAR
8	BBSR-1	BCDD-2	Sainik School
9	BBSR-1	BCDD-2	VANIVIHAR ODSSP
10	BBSR-1	BCDD-2	NAYAPALLI
11	BBSR-1	BCDD-2	XAVIER
12	BBSR-1	BCDD-2	CS PUR-1
13	BBSR-1	BCDD-2	OLD BARANGA
14	BBSR-1	BCDD-2	GODISAHI
15	BBSR-1	BCDD-2	KALARAHANGA
16	BBSR-1	BCDD-2	ESI
17	BBSR-1	BCDD-2	Ransinghpur
18	BBSR-1	BCDD-2	GOTHAPATNA
19	BBSR-1	BCDD-2	KHANDAGIRI
20	BBSR-1	BCDD-2	DUMDUMA
21	BBSR-1	BCDD-2	BARAMUNDA
22	BBSR-1	BCDD-2	CHANDAKA
23	BBSR-1	BCDD-2	RRL
24	BBSR-1	BED	RASULGARH
25	BBSR-1	BED	Mancheswar
26	BBSR-1	BED	PHULNAKHARA
27	BBSR-1	BED	Laxmisagar
28	BBSR-1	BED	NAHARKANTA
29	BBSR-1	BED	SBI KESURA
30	BBSR-1	BED	Uttara
31	BBSR-1	BED	BHINGARPUR
32	BBSR-1	BED	KALPANA ODSSP
33	BBSR-1	BED	MULAPADIA ODSSP
34	BBSR-1	BED	LINGIPUR ODSSP
35	BBSR-1	BED	Pandara
36	BBSR-1	BED	Chakeisiani

2.3.9 Primary substation with Single power TRF

Nearly 4% of existing PSS have only one 33/11kV power transformer. As primary substations are distantly apart, and since there is not much interconnectors available at 11kV system level, outage of this single power transformer due to periodic maintenance or in case of breakdown results in loss of power supply to all consumers connected to the same primary substation. Ideally, each 33/11kV PSS should have at least two power transformers of same rating to provide N-1 redundancy. The PSS with a Single Power Transformer are as follows:

Table 15 Primary Substation single Power transformer

Sl. No.	Circle	Division	Name of the PSS	Category	Capacity (MVA)	Loading (in MVA)
1	BBSR-1	BCDD-2	KALARAHANGA	Urban	8	4.53
2	BBSR-1	BED	SBI KESURA	Urban	8	1.9

2.3.10 Primary Substation with PTR N-1 fail Issues

Ideally, each primary substation should have at least two power transformers of rated capacity in such a way to feed power supply to all consumers connected to this PSS even if one power transformer is out due to maintenance or breakdown. During analysis number of power Transformers in primary substations failed N-1 criteria as far as power transformers is concerned. The N-1 failed due to various reasons such as absence of 11KV Bus coupler for load transferring from one PTR to other PTR in the event of one PTR outage, Overloading of PTR against its capacity while feeding the second PTR load in the event of outage.

The PTR N-1 redundancy can achieve through various measures like upgradation of PTR to higher rating, provision of 11kV Bus coupler & RMU for load transferring during contingency, ring connectivity at 11kV feeder level to transfer the load to other PSS.

Table 16 Primary Substation with N-1 fail issues

Sl. No.	Circle	Division	PSS Name	PTR No.	PTR Capacity in MVA	Peak Load in MVA	Loading	N-1 Status	Remarks
1	BBSR-1	BCDD-1	UNIT-6	PTR-1	5	2.6	52%	FAIL	
2	BBSR-1	BCDD-2	Sainik School	PTR-1	8	5.14	64%	FAIL	
3	BBSR-1	BCDD-2	Sainik School	PTR-2	8	3.49	44%	FAIL	
4	BBSR-1	BCDD-2	NAYAPALLI	PTR-1	12.5	8.06	64%	FAIL	11KV Bus coupler is
5	BBSR-1	BCDD-2	NAYAPALLI	PTR-2	12.5	8.1	65%	FAIL	not available between
6	BBSR-1	BCDD-2	NAYAPALLI	PTR-3	8	3.49	44%	FAIL	PTR-2&3
7	BBSR-1	BCDD-2	CS PUR-1	PTR-1	8	5.2	65%	FAIL	
8	BBSR-1	BCDD-2	CS PUR-1	PTR-2	8	6.34	79%	FAIL	
9	BBSR-1	BCDD-2	CS PUR-1	PTR-3	5	2.21	44%	FAIL	
10	BBSR-1	BCDD-2	CS PUR-2	PTR-1	8	0	0%	FAIL	
11	BBSR-1	BCDD-2	CS PUR-2	PTR-2	8	6.06	76%	FAIL	
12	BBSR-1	BCDD-2	CS PUR-2	PTR-3	8	5.71	71%	FAIL	
13	BBSR-1	BCDD-2	CS PUR-2	PTR-4	12.5	8.99	72%	FAIL	
14	BBSR-1	BCDD-2	NEW BARANGA	PTR-1	8	3.56	45%	FAIL	11KV Bus coupler is
15	BBSR-1	BCDD-2	NEW BARANGA	PTR-2	8	0	0%	FAIL	not available between
16	BBSR-1	BCDD-2	KANANVIHAR	PTR-1	12.5	7.24	58%	FAIL	
17	BBSR-1	BCDD-2	KANANVIHAR	PTR-2	8	5.96	75%	FAIL	
18	BBSR-1	BCDD-2	KALARAHANGA	PTR-1	8	4.53	57%	FAIL	Single PTR
19	BBSR-1	BCDD-2	KALINGA NAGAR	PTR-3	8	3.39	42%	FAIL	
20	BBSR-1	BCDD-2	BHARATPUR	PTR-1	8	5.68	71%	FAIL	
21	BBSR-1	BCDD-2	BHARATPUR	PTR-2	8	5.14	64%	FAIL	
22	BBSR-1	BCDD-2	BHARATPUR	PTR-3	5	1.28	26%	FAIL	
23	BBSR-1	BCDD-2	KHANDAGIRI	PTR-1	12.5	6.61	53%	FAIL	
24	BBSR-1	BCDD-2	KHANDAGIRI	PTR-2	8	6.82	85%	FAIL	
25	BBSR-1	BCDD-2	DUMDUMA	PTR-1	8	7.12	89%	FAIL	
26	BBSR-1	BCDD-2	DUMDUMA	PTR-2	8	5.33	67%	FAIL	
27	BBSR-1	BCDD-2	BARAMUNDA	PTR-1	8	4.1	51%	FAIL	
28	BBSR-1	BCDD-2	BARAMUNDA	PTR-2	8	4.95	62%	FAIL	
29	BBSR-1	BED	BADAGADA	PTR-1	12.5	8.5	68%	FAIL	
30	BBSR-1	BED	BADAGADA	PTR-2	12.5	9	72%	FAIL	
31	BBSR-1	BED	BADAGADA	PTR-3	12.5	5.6	45%	FAIL	
32	BBSR-1	BED	BADAGADA	PTR-4	10	6.5	65%	FAIL	
33	BBSR-1	BED	BHIMATANGI	PTR-1	8		0%	FAIL	
34	BBSR-1	BED	Mancheswar	PTR-2	8	4.1	51%	FAIL	
35	BBSR-1	BED	Mancheswar	PTR-3	12.5	4.9	39%	FAIL	
36	BBSR-1	BED	PHULNAKHARA	PTR-1	5	2.6	52%	FAIL	
37	BBSR-1	BED	PHULNAKHARA	PTR-2	5	2.9	58%	FAIL	
38	BBSR-1	BED	PHULNAKHARA	PTR-3	5	1.6	32%	FAIL	
39	BBSR-1	BED	Laxmisagar	PTR-1	12.5	9	72%	FAIL	
40	BBSR-1	BED	Laxmisagar	PTR-2	12.5	7.6	61%	FAIL	
41	BBSR-1	BED	Laxmisagar	PTR-3	12.5	9	72%	FAIL	
42	BBSR-1	BED	NAHARKANTA	PTR-1	8	4.9	61%	FAIL	
43	BBSR-1	BED	NAHARKANTA	PTR-2	8	4.4	55%	FAIL	
44	BBSR-1	BED	SBI KESURA	PTR-1	8	1.9	24%	FAIL	Single PTR
45	BBSR-1	BED	Uttara	PTR-1	8	2.5	31%	FAIL	
46	BBSR-1	BED	Uttara	PTR-2	8	6.4	80%	FAIL	
47	BBSR-1	BED	MULAPADIA ODSSP	PTR-1	8	4.6	58%	FAIL	
48	BBSR-1	BED	MULAPADIA ODSSP	PTR-2	8	3.7	46%	FAIL	
49	BBSR-1	BED	Chakeisiani	PTR-1	5	0.5	10%	FAIL	11KV Bus coupler is not available between PTR-1 & 2
50	BBSR-1	BED	Chakeisiani	PTR-2	5		0%	FAIL	

2.3.11 Poor Electrical & Civil infrastructure in PSS

Boundary walls are broken and there is no fencing of the outdoor switchyards in almost all conventional 33/11kV primary substations. The newly constructed primary substations under different government funded schemes also do not have proper boundary walls, concertina wire, and fence between switchyard and rest of the substation. Many of the substation control rooms are being used as section offices and outdoor switchyard as stores.

The control room at many primary substations are either inadequate to house all equipment or are in extremely dilapidated condition. This makes the primary substations highly unsafe for operation. Stray animals and unauthorized persons can enter into the PSS and may cause incident / accident. Apart from this, earthing system is in a very bad condition and have over lived its life at old substations, many breakers and CTs are bypassed thus compromising the protection system.

C. 11 KV Feeders

2.3.12 Poor condition of 11kV Feeder

11kV feeders are the main power link between Primary substations (PSS) with the distribution substation (DSS) and give power supply to 11kV HT consumers. Below are the major observations in the existing 11kV network:

- Many 11kV feeders have conductor of different sizes used in different phases, which restricts the circuit capacity limiting to the lowest size of the conductor used in the circuit. This lead to overloading of the feeder, low voltage issue and Higher Technical losses.
- Most of the places, the protection devices (Lighting arrester, LT Distribution Board (LTDB) and Air Break (AB) Switch) are either not available or in bypassed condition.
- Interconnection between feeders mostly are done through jumpering and some places through off-load AB switches, for normal load transferring from one feeder to another feeder it requires shutdown of both feeder.
- Most of the feeders are passing through dense vegetation area and this leads frequent tripping of feeder on Transient fault.
- The feeders are lengthy with multiple T-off branches without Sectionalizer or isolating device. Any fault in any of the branches leads to shutdown of entire feeder and it takes longer time for restoration since disconnection of the faulty branches requires physical disconnection.
- Approximately 8% of the 11kV feeder are overloaded.
- Many of the feeders are having binding wire / multiple joints in a single span. As a result, there are chances of snapping of conductors and subsequent electrocution

of human beings / animals since cradle guards are not provided.

- Houses / Structures are found constructed directly below 11kV feeders / close to 11kV feeders at many locations both in urban and rural areas.
- It is also observed that no intermediate H-poles are used in 11kV feeders for mechanical strength and for conductor jointing. These double poles are essential to avoid cascading effect of failure of poles uprooting during any disaster.
- Large number of interruptions were reported on 11kV feeders prior to TPCODL commencing operation on 1st June 2020 (>250 per feeder per annum). The trend has been as follows:

Figure 4 :11 KV Feeder Tripping Analysis – FY 20-21

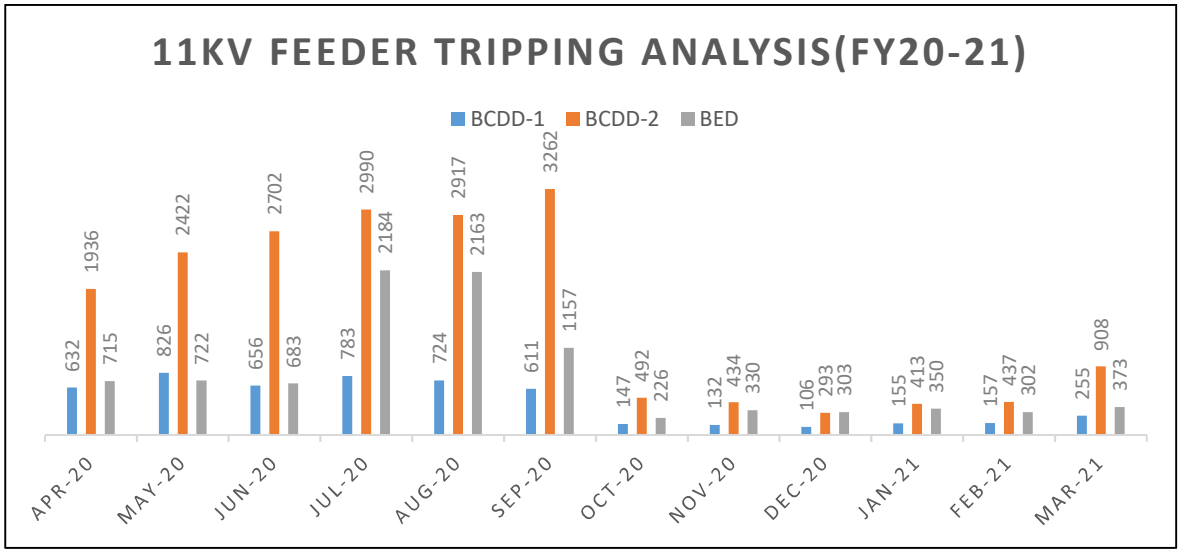
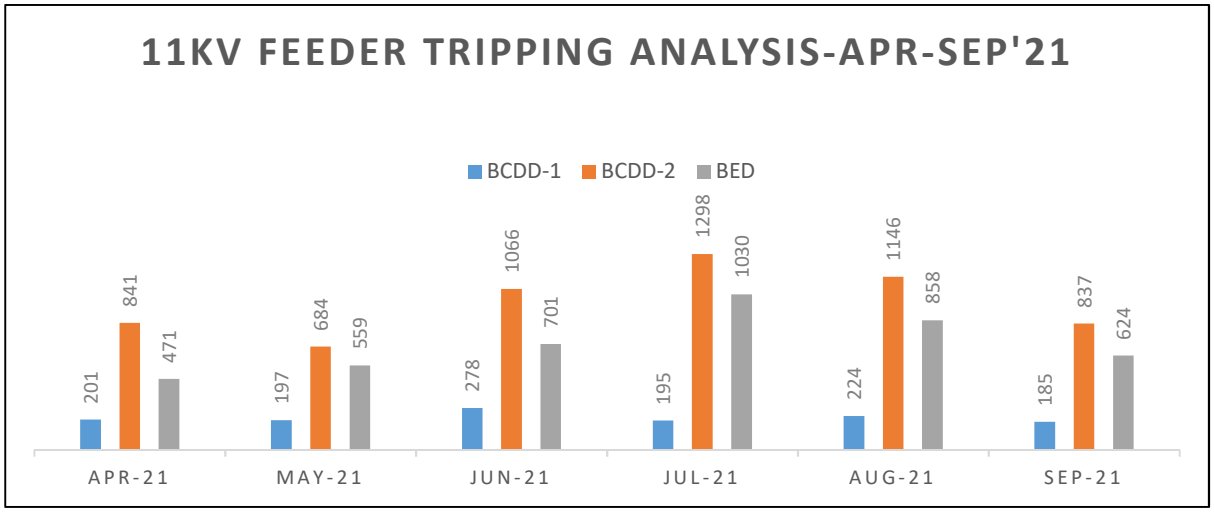


Figure 5 :11 KV Feeder Tripping Analysis (Apr-Sep 21)



The Total count of 11kV feeders in Bhubaneswar City as on September 2021 is 235 numbers. As can be seen from the graph, total fault tripping's were 11395 from April to September 2021 with total outage of 1950.23 hours. So on an average, each 11kV feeder had tripped 48 times during this period. Further, though after taking over by TPCODL the tripping trends has reduced significantly through proper preventive and condition based maintenance approach., there is huge scope for further improvement to ensure delivery of reliable and quality power supply to the end users.

D. Distribution Transformers

2.3.13 Poor Electrical & Civil infrastructure in 11/0.433kV DSS

11/0.433kV primary substation (DSS) boundary walls are either broken or there is no fencing of the outdoor distribution substation. This makes the DSS unsafe for stray animals and provides access to unauthorized peoples. In most of the Distribution Substations, Air Break Switches, DD Fuse units, LV Protection devices are bypassed. Apart from this, earthing system in Primary and Distribution Substation and feeders is in deteriorated condition. Fuse arrangements at Distribution Substations are installed at low height and exposed to animals and children, making them highly unsafe and thereby creating a potential safety hazard.

2.3.14 Higher DT Failure Rate

Due to absence of preventive and condition based maintenance and other protection devices, failure rate of Distribution Transformers in BBSR city is approximately 3% of total volume. From April-21 to September-21, 265 Nos. of Distribution Transformers have failed. The statistics on the same is as follows

Table 17 DT Failure Statistics

DT Failures April-21 to September-21				
Division	**BCDD-I**	**BCDD-II**	**BED**	**TOTAL**
Total No of DT	1521	3512	3630	8663
DT Failure (Nos.)	40	121	104	265
Capacity(KVA)	8252	18238	14992	41482

E. Environmental Challenges

Odisha is one of the most vulnerable states in India as far as cyclones are concerned. In view

of its tropical location and the long coastline, Odisha has been recurrently affected by cyclones, which are often followed with floods. Generally, two cyclone seasons prevail over Odisha. One is during pre-monsoon period (i.e. April, May and June up to onset of monsoon) and another is in the post monsoon season (i.e. October to December) in terms of seasonality of occurrence. The cyclones which have had landfall in Odisha coast normally originates in the Bay of Bengal and adjoining seas and dissipate on the land. Most devastating cyclones had occurred in Odisha in the months of May or October and their impacts on power infrastructure have been so severe that it has been able to cripple the economy of the state. The 1999, super cyclone has been the best example of it. "The state suffers from extreme weather like storms, droughts and floods. BBSR city is approximately 60km from Coastal belt and very vulnerable to cyclone. Since a very large part of the distribution systems in the BBSR City consist of overhead feeders with radial configuration, failures on distribution systems due to Cyclone, Lightning and localise cyclone are responsible for most of the interruptions experienced by customers.

2.4 Load flow study on As Is Network of BBSR city and Results

Load flow (LF) is one of the most important parts to study and analyse the power system operation. The purpose is to understand how power distribution network behaves while power flows around the electrical network. Carrying out a load flow study assists the engineer in Designing & Operation team whether the network is Operating Efficiently or not and what mitigation plan can help in mitigating the network inadequacies. The load flow study was carried out with help of CYME Dist. software.

2.4.1 Technical Losses

The results of the same are captured in the following tables:

Table 18: BBSR City 33kV Network Loss Assessment Division wise for As Is Network

Division	Installed Capacity (MVA)	Peak Load (MW) Excluding EHV	Average Load (MW) Excluding EHV Load	Line Loss in MW	Cable Loss in MW	Trf. ("No Load" Loss) in MW	Trf. ("Load" Loss) in MW	Total Loss (in MW)	Total Loss with LLF	losses in %
BCDD-I	211.5	63.41	40.82	2.25	0.00	0.12	0.21	2.57	1.25	3.05
BCDD-II	399.7	158.11	98.97	2.55	0.19	0.23	0.54	3.51	1.67	1.69
BED	331	110.55	63.70	3.20	0.06	0.19	0.34	3.79	1.56	2.45
BBSR City	**942.2**	**332.06**	**203.49**	**8.00**	**0.25**	**0.54**	**1.08**	**9.87**	**4.48**	**7.19**

Table 19: N-1 Status for 33kV Feeders & Power Transformer

Parameters	Total Nos.	Total No. of N-1 Failed cases	% cases without N-1 Compliance
33kV Feeder	44	24	54%
Power Transformers (33/11 kV)	108	50	46.29%

Table 20: 33 KV Feeder N-1 Details

Division	TOTAL no. of 33kV Feeders	N-1 Fail Feeders	% of 33kV Feeders with N-1 Fail	Proposed in TPCODL CAPEX (FY:21-22)
BCDD- I	8	0	0%	0
BCDD- II	24	17	71%	13
BED	12	7	58%	2
TOTAL	**44**	**24**	**54%**	**15**

Note : After the execution of Capex Schemes initiated in FY 2021-22 scheme the N-1 redundancy of 33kV feeder will improve from 46% to 80%. For achieving N-1 redundancy in 33kV network, remaining proposals will be submitted in subsequent year CAPEX.

Table 21: 33 KV Feeder N-1 failure details load category wise

	33kV Feeder N-1 Fail Details				Total
Circle	INDUSTRIAL	RURAL	Semi Urban	URBAN	
BCDD-1	0	0	0	0	0
BCDD-II	0	2	0	15	17
BED	0	1	0	6	7
Grand Total	**0**	**3**	**0**	**21**	**24**

Table 22: 33 KV Feeder N-1 OK details load category wise

	33kV Feeder N-1 OK Details				Total
Circle	INDUSTRIAL	RURAL	Semi Urban	URBAN	
BCDD-1	0	0	0	8	8
BCDD-II	1	0	0	6	7
BED	0	0	0	5	5
Grand Total	**1**	**0**	**0**	**19**	**20**

2.4.2 POWER TRF N-1 Analysis Division Wise:

The N-1 criterion of power Transformer states in an unexpected failure or outage of a single Transformer, the load of the affected transformer shall be able to fed from the other Power Transformer.

Table 23: 33 Power Transformer N-1 Analysis

Circle	PTR	N-1 OK	N-1 Fail	Proposal Capex FY:21-22 to achieve N-1	Proposal OPEX FY:21-22 to achieve N-1
BCDD-1	21	20	1	1	0
BCDD-II	50	23	27	0	9
BED	37	15	22	0	8
TOTAL	108	58	50	1	17

2.4.3 No of Primary Substation with Single Power TRF:

In BBSR City, mainly the 11kV feeders are radial, lengthy in km & is not having any interconnection. Those 33/11kV PSS which are having Single PTR, in the eventuality of any outage or failure all those consumers which are feeding from the PSS will remain affected for longer duration till the time the problem resolved.

Table 24: No of Substation with Single Power Transformer

Circle	No. of Primary Substation with Single PTR					% of PSS with Single PTR
	Total No. of PSS	Industrial	Rural	Urban	Grand Total	
BCDD-I	10	0	0	0	0	0%
BCDD-II	22	0	0	1	1	4.54%
BED	15	0	0	1	1	6.66%
Grand Total	**47**	**0**	**0**	**2**	**2**	**4.25%**

2.4.4 No of 33/11kV PSS with single 33kV Incoming source:

Single 33kV Incoming source to PSS is very much vulnerable in terms of maintaining power supply reliability to consumers. In ideal scenario, there must be at least two nos. of 33kV source should be made available to each PSS, so that any case any source goes out other source can restore fully or partial load.

Table 25: No of Substations with Single 33 KV Incoming Source

Circle	No of PSS	Single Source		Proposal to mitigate single connectivity			
		No	%	Capex 21-22	SCRIPS	IPDS/ODSSP/GOVT Project	Total
BCDD-I	10	4	40%	1	3	0	4
BCDD-II	22	10	45.45%	4	0	4	8
BED	15	7	46.66%	2	0	1	3
Grand Total	**47**	**21**	**44.68%**	**7**	**3**	**5**	**15**

Note: In existing scenario, the Single connectivity 33/11KV PSS is 44.68%, which will drop to 12.7% after execution of Capex proposals initiated in FY2021-22 Proposals ("TPCODL Capex FY 2021-22").

2.4.5 33kV Feeder Overloading Details

For network study, 33kV feeder overloading is considered for loading of the feeder beyond 100% of their installed capacity (as per conductor size). Total 4nos. of overloaded feeders are identified and mitigation proposal is already proposed and approved under Capex 21 – 22.

Table 26: 33 KV Feeder Overloading Details

Circle	No. of 33kV Feeders	No. of Feeders Overloaded	% of Feeder Overloaded	Proposals to mitigate overloading		
				Capex 21-22	IPDS/DDUGY/Govt Projects	Total
BCDD-I	8	0	0%	0	0	0
BCDD-II	24	4	16%	4	0	4
BED	12	0	0%	0	0	0
BBSR City	**44**	**4**	**9%**	**4**	**0**	**4**

Note: 100% feeder overloading issues will be mitigated after execution of TPCODL CAPEX 21-22.

2.4.6 Details of the low Voltage observed at 33/11kV PSS

As per CEA guidelines, voltage variation limit for 33kV should be within the limit of +6% and -9%. Below are the list category-wise Primary substations where 33kV incoming side voltage is

crossing the permissible limit of "-9%". The reason for this voltage drop is due to lengthy feeder, improper conductor size being used in the feeder, overloading of feeder etc.

Table 27: Details of Low Voltage PSS

Circle	PSS having 9% voltage drop in 33KV Incoming					Mitigation Proposals		
	Total No of PSS	PSS having low voltage issue	Rural	emi Urba	Urban	Capex 21-22	GOVT funded	Opex
BCDD-I	10	2	0	0	2	0	1	1
BCDD-II	22	4	0	0	4	2	2	0
BED	15	3	1	0	2	2	1	0
Grand Total	**47**	**9**	**1**	**0**	**8**	**4**	**4**	**1**

Note: 100% low voltage issues for 33KV incoming voltage of PSS in Bhubaneswar City area will be mitigated after execution of TPCODL Capex 21-22.

Table 28: % of Voltage Variation with respect to Load Category

Range of % Voltage Drop	INDUSTRIAL	RURAL	URBAN	SEMI URBAN	TOTAL	% of total Structures in respective Voltage Bands
0-3%	0	1	5	0	6	12.70%
3-6%	0	1	11	0	12	25.53%
6-9%	2	5	10	3	20	42.55%
9-12%	0	0	7	0	7	14.89%
>12%	0	1	1	0	2	4.25%
Total	**2**	**8**	**34**	**3**	**47**	

2.4.7 11kV Network Reliability Analysis

11kV Network analysis has been done manually instead of using load flow software. 11kV network of all three Divisions studied for contingency analysis and overloading using past load trend data and studied for as is network and for 2 years down the line considering load growth.

Table 29: 11 KV Network Reliability Statistics

Division Name	No. of 11KV Feeders	No. of 11KV FDR having N-1 Issue	No.of 11KV FDR is Radial	Mitigation proposal in TPCODL Capex FY21	Mitigation proposal in TPCODL Capex FY22	No of Overloaded feeders
BCDD-I	67	9	5	2	-	0
BCDD-II	100	49	0	22	1	8
BED	68	30	10	19	5	10
Total	**235**	**88**	**15**	**43**	**6**	**18**

Basis on the study, it is observed that most of the 11kV feeders do not have N-1 redundancy and even some of them are in radial mode. Most of the Distribution substations are in dilapidated condition with equipment having operational defects causing high outage time and delay in restoration of power supply.

2.5 Proposed Capex Plan to achieve 24x7 network reliability

As explained earlier, TPCODL has identified a number of challenges related to safety, 33kV/11kV/0.415kV network, civil infrastructure and climate change. These challenges are planned to be addressed through a systematic investment plan by TPCODL to maintain 24x7 power supply in the BBSR city area. The proposed CAPEX plan is apart from what we have submitted so far and got approved from the Hon'ble Commission under CAPEX – FY 2020 - 21 & FY 2021 - 22 to represent a justified and efficient level of total capital investment estimated by TPCODL to meet the service obligation; improving safety, reliability of network, improve the level of service standards.

To maintain 24x7 reliable power supply, need is also felt to improve the existing facilities and infrastructure to provide a better consumer experience and a modern, rich, and conducive provision 11kV Bus coupler, PTR upgradation & interconnector between PSS to achieve work environment to all employees for better performance.

2.5.1 CAPEX Investment proposal to achieve 24x7 reliable power supply to BBSR City

Given the network condition above to ensuring 24x7 reliable power supply to each consumer of BBSR city area, huge capital investment is required to take up the task of system revamping and overall network upgradation. It has proposed to do the investment under following category.

a) 33kV ring network to improve reliability & make the system disaster resilient.
b) Installation of 33kV RMU in network for T-off locations.
c) Provision 33kV Bus coupler at PSS.

d) Improvement in PTR N-1 redundancy at PSS.
e) Improvement in 11kV feeder Infrastructure to make disaster resilient & achieve N-1 redundancy.
f) Refurbishment of DSS for improve reliability & safe operation.

The summary of the CAPEX expenditure given in below Table

Table 30: Capital Expenditure for Reliability Study

Sl. No	Activities Proposed	Total Cost in Cr
1	Power evacuation from upcoming OPTCL GSS for 33kV network reliability improvement	24.81
2	Installation of 33kV RMU in network for T-OFF	7.56
3	Provision 33kV Bus coupler at PSS.	4.99
4	Improvement in PTR N-1 redundancy at PSS	8.91
5	Improvement in 11kV feeder reliability	36.36
6	Existing FPI for SCADA communication	0.5
7	Provision of LTDB at DSS	17.23
	Total	**100.36**

2.5.2 Power evacuation from upcoming OPTCL GSS for 33kV network reliability improvement

There are 3No's OPTCL Grid substation (Nayapalli, Badagada & Godisahi) where commissioning work is going on at full swing by OPTCL in BBSR City & is expected to get commissioned by 30th December 2022. It is proposed to evacuate power from the upcoming OPTCL GSS to nearby TPCODL 33/11KV PSS, which will help to optimise asset loading of OPTCL GSS as well as TPCODL 33KV lines & PSS. Under power evacuation scheme, It is proposed to lay new 33KV feeders from the upcoming OPTCL GSS & connect with the nearby TPCODL 33/11kV PSS which will help to improve power supply reliability to consumers in BBSR city area during preventive & breakdown activities, reduction in technical losses & improved in voltage profile. The approximate. costing for 33kV power evacuation & system reliability improvement is given in below table:

Table 31: Power Evacuation Plan from upcoming OPTCL GSS

Sl. No.	Upcoming GSS Name	From	TO	No of 33kV Bay's to be utilised	Ckt. Length in KM	Type of Network	Total Cost in Cr
1	Nayapalli	Nayapalli GSS	Bharatpur PSS	1	5	U/G	**9.47**
2		Nayapalli GSS	Nayapalli PSS	1	0.5	U/G	**1.27**
3		Nayapalli GSS	Board colony	1	3.2	U/G	**6.26**
4	Badagada	Badagada GSS	Badagada PSS	2	0.4	U/G	**1.35**
5		Badagada GSS	Laxmisagar -1&2 NBLS	2	0.4	U/G	**1.31**
6	Godisahi	Godisahi GSS A)Conductor augmentation of 33KV Barang feeder from 55sqmm to 148sqmm- 7km (interposing H-Pole), B) New 33KV feeder with 148sqmm length of 2Ckt Km Na C)0.3km UG from Godisahi PSS to Naraj feeder	Barang & Godisahi	2		O/H+U/G	**2.52**
7	Chandaka-A*	Chandaka-II Feeder	CSPUR-II		0.38	U/G	**1.2**
8	UNIT-8*	Cable replacement 3CX300 to 1CX630sqmm UNIT-8 GSS	UNIT-8 PSS		1.15	U/G	**1.43**
		Total		9			**24.81**

* Existing GSS

2.5.3 Installation of 33kV RMU in network for T-OFF:

In existing T-OFF network all operation is done manually & in off load state which requires shutdown of the feeder. The existing T-OFF network does not have facility to provide existing Isolator/AB Switch status for remote communication with PSCC SCADA system. To avoid all challenges, it is proposed to replace the T-OFF with Isolator RMU which has advantage that it can operate on load, compact in design, can operate remotely & with added advantage of in built Fault passage indicator facility. This fault passage indicator help the operator to identify the faulty section & take quick decision for power supply restoration. The operation & restoration will done within 5 minutes, which earlier used to take minimum 20-25 minutes. The approximate. costing for 33kV RMU in T-off locations is shown in the following table:

Table 32: Installation of 33 KV RMU in network for T-Off

Sl. No.	Division	Grid Name	33kv Feeder Name	T-OFF location	Proposal	4W RMU (in No.)	3W RMU (in No.)	Cost (in
1	BCDD-2	Chandaka	Infocity	Infocity Gate	Installation of 2 no. 4W RMU	2		0.89
2	BCDD-2	Chandaka	SJ Developers	Royal Lagoon (SJ)	Installation of 1 no. 3W RMU		1	0.38
3	BCDD-2	Chandaka	SJ Developers	Kalarahanga T-OFF	Installation of 1 no. 4W RMU	1		0.49
4	BCDD-2	Chandaka	CS pur-2	RIL Consumer Tap OFF	Installation of 1 no. 4W RMU	1		0.46
5	BCDD-2	Chandaka	CS pur-1	IOCL petrol pump- Club Town	Installation of 1 no. 3W RMU		1	0.36
6	BCDD-2	Chandaka	CS pur-1	Damana Chowk	Installation of 1 no. 4W RMU	1		0.46
7	BCDD-2	Chandaka	Xavier	KIIT Chowk	Installation of 2 no. 3W RMU		2	0.75
8	BCDD-2	Chandaka	Xavier	XIMB square	Installation of 1 no. 4W RMU	1		0.46
9	BCDD-2	Mancheswar	Fdr-9	Railway 4Pole	Installation of 2 no. 3W RMU		2	0.8
10	BCDD-2	Mancheswar	Fdr-8	Railway 4Pole	Installation of 1 no. 3W RMU		1	0.39
11	BCDD-2	Mancheswar	Sainik School	Sainik School Tap off	Installation of 1 no. 3W RMU		1	0.39
12	BCDD-2	Chandaka	Barang	Old Section office	Installation of 1 no. 3W RMU		1	0.39
13	BCDD-2	Chandaka	Naraj	Gobindpur 6P	Installation of 1 no. 4W RMU	1		0.45
14	BED	Kesura	Lingipur	Lingipur Toff	Installation of 1 no. 3W RMU		1	0.39
15	BCDD-2	Ranasinghpur	Assotech	Bangali Basti Kalinganagar Toff	Installation of 1 no. 4W RMU	1		0.51
			Total			**8**	**10**	**7.56**

b. <u>Provision of 33kV Bus coupler at PSS</u>

There are 51 Nos. of PSS in BBSR City out of which 36 Nos. of PSS are not having 33kV Bus coupler for split operation of power Transformer. After installation of these 33kV Bus coupler / RMUs, it will help to operate different PTR of same PSS from separate sources. In case of any source goes out there will momentary shutdown to part consumers & immediately load can be shifted to second source by closing the bus coupler. This will help to optimised utilisation of existing asset. The approx. costing for provision of 33kV Bus coupler/ RMU is given in the following table:

Table 33: Cost for provision of 33 KV Bus Coupler at PSS

Sl. No.	Circle	Division	Structure Name	Total Cost (in Crores)
1	BBSR-1	BCDD-1	SAHID NAGAR	0.45
2	BBSR-1	BCDD-1	Board Colony	0.15
3	BBSR-1	BCDD-1	AIRPORT	0.15
4	BBSR-1	BCDD-1	DELTA	0.15
5	BBSR-1	BCDD-1	UNIT-6	0.45
6	BBSR-1	BCDD-1	UNIT-3	0.3
7	BBSR-1	BCDD-1	UNIT-4	0.3
8	BBSR-1	BCDD-1	SATYA NAGAR	0.15
9	BBSR-1	BCDD-2	Sainik School	0.45
10	BBSR-1	BCDD-2	NAYAPALLI	0.3
11	BBSR-1	BCDD-2	XAVIER	0.15
12	BBSR-1	BCDD-2	CS PUR-1	0.15
13	BBSR-1	BCDD-2	INFOCITY	0.15
14	BBSR-1	BCDD-2	ESI	0.15
15	BBSR-1	BCDD-2	BHARATPUR	0.3
16	BBSR-1	BCDD-2	KHANDAGIRI	0.15
17	BBSR-1	BED	Laxmisagar	0.15
18	BBSR-1	BED	BHIMATANGI	0.3
19	BBSR-1	BED	RASULGARH	0.3
20	BBSR-1	BED	BHINGARPUR	0.15
21	BBSR-1	BED	Chakeisiani	0.15
		Total Cost		**4.99**

c. <u>Improvement in PTR N-1 Redundancy</u>

For N-1 criteria of a 33/11kV PSS, a situation has to be considered where the PTR with the largest capacity in the 33/11kV PSS will be out of service, and the other PTRs has to be working at a capacity of 90% of their installed capacity. If this condition is met, then the PSS will be considered as N-1 OK .

For N-1 criteria of PTR, each PTR of a substation will consider as out of service and the other PTRs should work at 90% loading while catering the load of entire PSS. If this criterion is not meet, then the situation will be considered as N-1 Fail at Transformer level.

The PTR N-1 redundancy can be achieve through various measures like upgradation of PTR to higher rating, provision of 11kV Bus coupler & RMU for load transferring during contingency, ring connectivity at 11kV feeder level to transfer the load to other PSS. Since the no. of PTR N-1 failure is very high we have prioritised & considered only those PTR's whose loading is more than 65% & feeding to critical installation & urban loads.

The approx. costing for replacement of 3No's of PTR is given below:

Table 34: Cost for PTR replacement at PSS

Sl. No.	Division Name	PSS Name	PTR Name	Rating in MVA	Loading in MVA (FY21)	% of loading	Load Growth (%)	Loading in MVA (FY24)	Proposed Rating in MVA	Costing in Cr
1	BED	Laxmisagar	PTR-1	12.5	8.152	65%	5.46%	9.07	20	3.31
2	BED	Laxmisagar	PTR-3	12.5	8.838	71%	5.46%	9.83	20	3.31
3	BCDD-2	Bharatpur	PTR-1	8	5.657	71%	6.83%	6.46	12.5	2.28
				Total Costing						**8.91**

d. <u>Improvement in 11kV feeder Infrastructure to achieve N-1 Redundancy</u>

As per criteria of N-1 Redundancy at 11KV feeder level, in case of any outage or fault or any condition on primary feeder which might lead to non-availability of power supply, a minimum of one back-up feeder is to be considered for back feeding so that even in the case of faulty section, consumer supply should not get disrupted. For mitigation of N-1 at feeder level, radial feed (U/G and O/H) shall be provided with a suitable back-feeding arrangement. This back feeding is proposed from either same substation but different transformer or different substation transformer based on feasibility & least cost. Hence, to ensure highest reliability, all the feeders are proposed to be interconnected through any other feeder through On load break switches / RMU so that load of primary feeder can be transferred without taking shutdown for transferring the affected feeder load to healthy feeder. It is also proposed to install auto-reclosure / sectionaliser in fault prone T-Off branches to avoid unnecessary shutdown to other branches or main trunk line and ultimately to the consumers connected to healthy sections. To mitigate overloading scenario, the overloaded section of the feeders are proposed for augmentation with higher rating conductor size to enhance the circuit capacity. Some of the important network feeding Key consumers & important installations are proposed for underground network conversion for achieving highest reliability. The proposals considered hereby are excluding the proposals that were approved under CAPEX – FY 20-21 & FY 21-22.

<u>11kV network Infrastructure</u>

In this head, all such issues can be mitigated by augmenting the existing 11kV feeder to address overloading issues of the feeders. This will help in strengthening the existing 11kV system.

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.

AR, FPI, RMU

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 therefore to attend/work at LT feeder, outage is required to be taken from 33/11kV structure which results into interruption to all consumers connected to particular 11kV feeder.

Moreover, in Bhubaneswar city area, interconnectors & load break switches are required to address the issue of overloading, load shifting during exigencies & improving reliability.

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.

TPCODL would like to introduce communicable type Fault Passage Indicator, Auto-reclosure & Sectionaliser. This will help in improving the reliability of the power distribution network.

The benefit to consumer:

- Reliable power supply to consumers
- Improvement in reliability Indices like SAIDI & SAIFI.

The approx. costing is shown in the following table:

Table 35: Cost for Improvement of 11KV Network reliability

Sl. No.	Division	TOTAL (in Cr.)
1	BCDD-I	8.45
2	BCDD-II	14.88
3	BED	13.03
TOTAL		36.36

e. Existing FPI for SCADA communication

Presently, in many areas, the FPIs are not SCADA communicative. It is required to enable the existing FPI with communication with SCADA to empower the field officials to locate the fault easily and this will in turn help to address and rectify the fault in short period of time.

The approx. costing is show cased in the following table:

Table 36: Cost for making Existing FPI Communicable

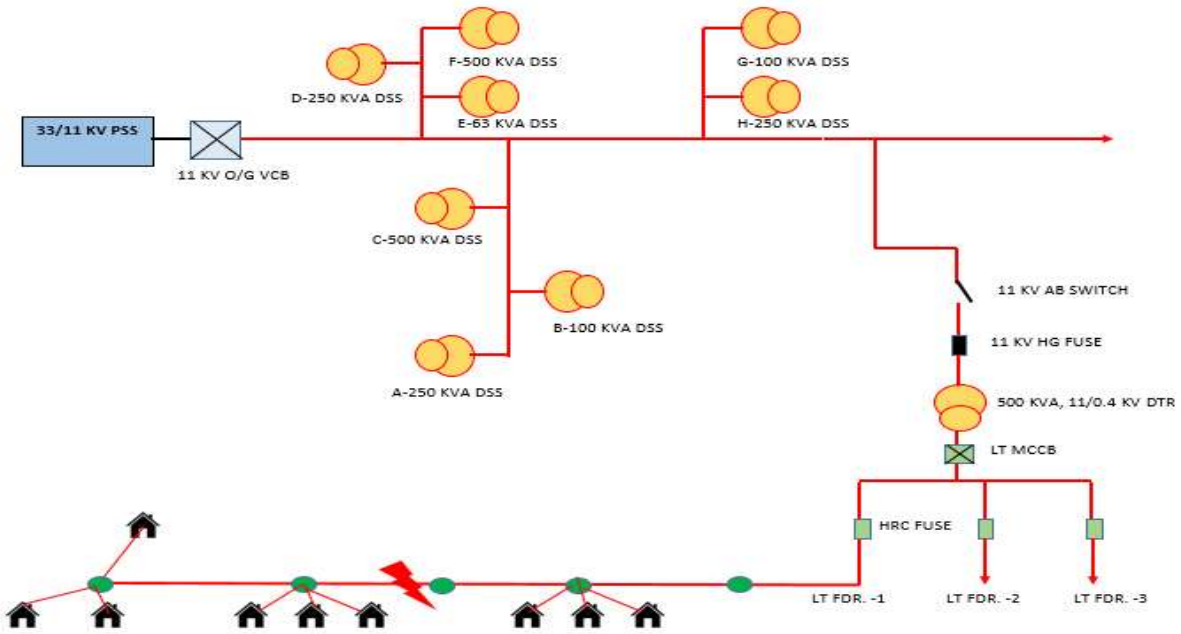
Description	Locations	Total Amount (Rs Cr)
Provision for existing FPI for SCADA communication	50	0.5

f. Provision of LTDB at DSS

Distribution Substation (DSS) comprises of various equipment, which perform specific task to ensure delivering the power supply at appropriate voltage to the end consumers. Main components are 11kV AB Switch, 11kV HG Fuse, Transformer, LV Protection, Earthing, Fencing and LT Distribution Box.

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. It has observed at many location the LT side & HT Side protection is bypassed through GI Wires. Due to this bypassed scenario, for any maintenance or corrective work at LT level, due to non-availability of switching equipment, outage / Hand trip is taken from the 33/11kV PSS resulting into interruption to all the consumers connected on that 11KV feeder even though for a short duration. Similarly, for any fault on LV Side lead to tripping of 11KV Feeder breaker at DSS.

Figure 6 Illustration of impact of Fault on the LV side



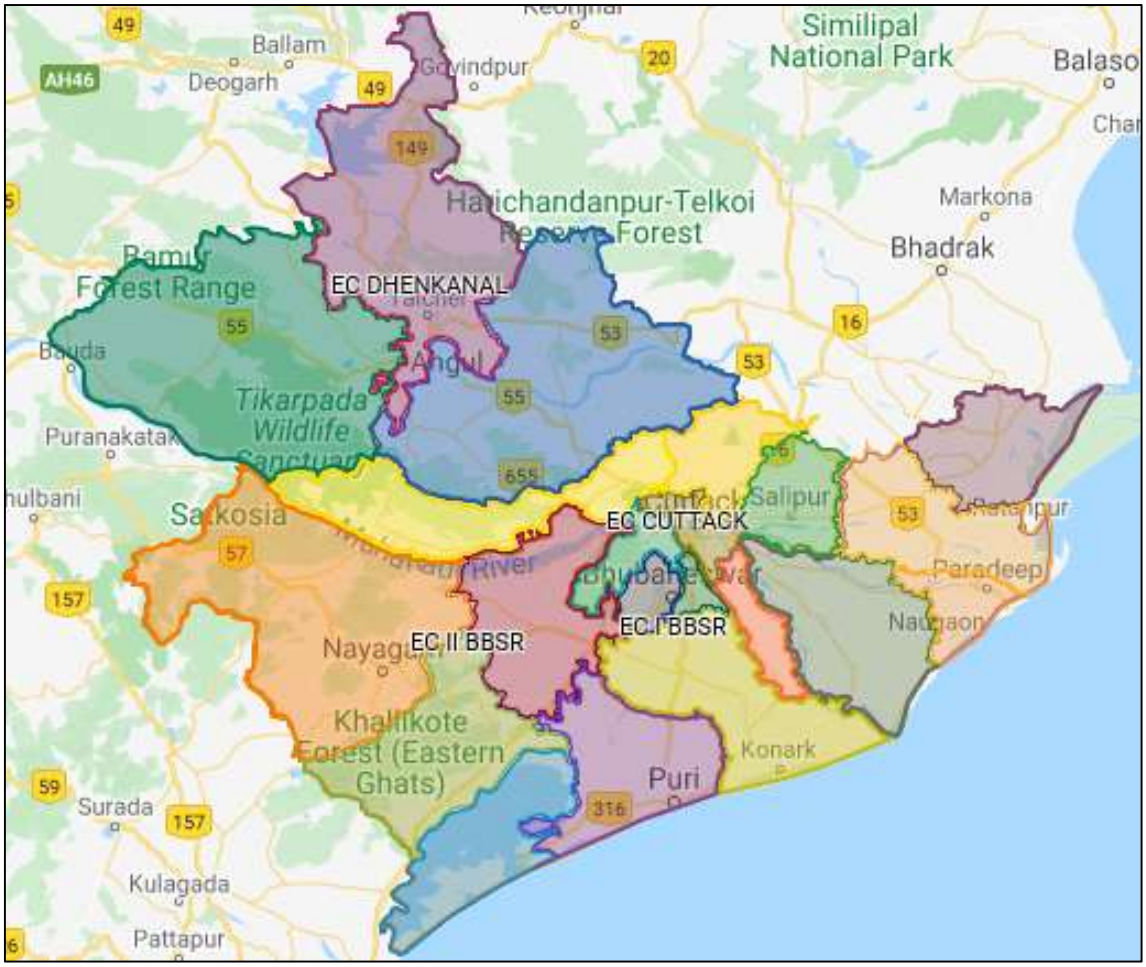
However, this can be addressed by installing a LTDB after Distribution transformer so that only that LT feeder needs to be taken into outage where the work is supposed to be carried out. The main function of LTDB is to individually control the LT feeders thus helping in attending the complaint of any feeder without disturbing the power supply to other LT feeders from same Distribution transformer. This will help in reducing the affected consumer count and thus improving the reliability indices.

It is therefore recommended to carry out the refurbishment of the Distribution substation above 100 KVA so that majority of the consumers are benefitted. The approx. costing for provision of LTDB is given in below Table:

Table 37: Capital Cost of LTDB

Sl. No.	Description	Installed Asset Details (Nos)	Proposed in CAPEX FY 2020-21 (Nos)	Proposed in CAPEX FY 2021-22 (Nos)	Total No of LTDB Remaining (Nos)	No. of LTDB to be provided in CAPEX FY: 2022-23 (In Nos)	Amount (In Cr)
1	500KVA DSS	777	334	47	396	124	3.44
2	250KVA DSS	1657	351	21	1285	420	8.97
3	100KVA DSS	2243	320	0	1923	644	4.83
	Total	**4677**	**1005**	**68**	**3604**	**1188**	**17.23**

3 Annexure 2- Mitigation of Low Voltage in Areas



Detailed Project Report (DPR)

for

33/11KV Substation by TPCODL with New Lines for mitigating Low voltage Areas

3.1 Background:

Distribution is the most critical segment of the electricity business chain. The real challenge in the power sector today lies in efficient management of the distribution sector. Availability of a robust sub-transmission and distribution network along with adequate metering arrangements is the need of the day for efficient management of the distribution system

Electricity is the key ingredient for accelerated economic growth and is considered vital for nation's overall development. Providing reliable and quality power supply in an efficient manner is an immediate requirement of the day. Amongst the three major layers of Power Sector i.e. Generation, Transmission and Distribution, the Distribution Sector has direct interface with the end consumers and is largely accountable for consumer satisfaction and for flow of revenues in the entire value chain of Power Sector. Thus, Distribution Sector plays a significant role in sustenance as well as growth of the Power Sector.

There is a consistent increase in electricity demand, particularly in urban areas, due to increase in customer base, changes in lifestyle and consumption pattern, which requires continual up-gradation and creation of infrastructure for electricity distribution.

Below is the table on Voltage regulation as per CEA guidelines

Rating	Voltage Regulation
33 kV	+6 % to -9 % over declared System voltage
11 kV	+6 % to -9 % over declared System voltage
650 V & Below	+/- 6 % over declared System voltage

Voltage Limits (33kv)	
Nominal Volatge	33kv
Highest Voltage	34.98KV
Lowest Voltage	30.03kv

3.2 Low voltage pockets:

TPCODL Network is very vast & spread across in huge geography. There are many low voltage pockets are persist in Urban, Semi-Urban and Rural clusters of TPCODL license area. TPCODL has done load flow analysis of 33KV network & identified the lines & the PSS, which are main reason for low voltage.TPCODL has identified total 368No's low voltage pockets & 117No's of 33/11KV PSS are having low voltage issue.

3.3 Proposals to mitigate low voltage

To mitigate the Low voltages as well as to address the quality of power, TPCODL has come up with many proposals. Below are the list of solutions, which can help to reduce low voltage pockets.

1) **Construction of new 33/11KV PSS near to the load centre.**
2) **Augmentation of existing lower conductor size with higher size conductor.**
3) **Construction of new source 33KV line to reduce feeder length & loading.**
4) **Construction of new Transmission Grid substation near to load centre.**

Based on the load flow study TPCODL has proposed 27no's locations where 33/11KV Primary substations is required to be constructed, 26No's of new 33KV line , 115Ckt Km conductor augmentation which will resolve low voltage pockets & this will benefit directly to 5,86,520 no of consumers .

Out of these 27 location, 16 locations identified in Rural location where 210 low voltage pockets will be upgraded to improved voltage and 11 locations identified in Urban and Semi-Urban Areas where 158 low voltage pockets will be upgraded to improved voltage.

To execute the 27 no. of PSS, Government of Odisha is providing Fund to construct 16 no.s 33/11kv PSS in rural areas along with 18 no. of New lines from Low loaded Grid.

For remaining 11 no.s PSS, TPCODL will construct 33/11kv substation, which can help, eradicate low voltage problem. Construction of 5 no of New lines with total of **95.2KM** benefitting 27 no PSS and Conductor Augmentation from existing undersize conductor to higher ampacity Conductors at 9 no.s 33kv interconnection having length **104.85KM**.

Total cost of the DPR is Rs 287.81Cr The Break up is provided in Table below

Table 38: Breakup of Capital Expenditure for addressing LV problem

Sr No	Activities Descriptions	Qty	Unit	Cost in Cr
1	Construction of 33/11KV PSS	11	No's	240.04
2	Conductor Augmentation in Km	105	KM	15.77
3	Construction of new Line	95	KM	32
	Total Cost in Cr			287.81

The details of the scheme are as given in the following text and tables

3.4 PART-A – Construction of 11 no. of 33/11kv PSS

The summary of 11 no. substations to be taken in TPCODL CAPEX are as below: -

Table 39: Inventory of Proposed 33/11 KV PSS

Sl no	Name of Circle	Name of Division	Name of Site	Substation Capacity	Load category	Cost Estimate (in Cr)
1	BBSR-I	BCDD-II	Sri Vihar	2X8MVA GIS	URBAN	24.38
2	Dhenkanal	DED	Dhenkanal Town	2X8MVA GIS	URBAN	49.71
3	Dhenkanal	AnED	Panchamahala	2X8MVA GIS	Semi Urban	26.35
4	Cuttack	CED	Manguli	2X8MVA GIS	Semi Urban	17.51
5	BBSR-I	BCDD-II	Gadakan	2X8MVA GIS	URBAN	15.37
6	BBSR-II	PED	Satsankha	2X8MVA GIS	Semi Urban	18.52
7	Paradeep	KED-I	Kajala	2X8MVA GIS	Semi Urban	23.33
8	Paradeep	KED-I	Matiapala	2X8MVA GIS	Semi Urban	17.50
9	BBSR-II	KHD	Nabinabag	2X8MVA GIS	Urban	15.82
10	Cuttack	CED	Sai Vihar (OIE, Jagatpur)	2X5MVA GIS	URBAN	11.84
11	BBSR-I	BED	Meherapalli	2X8MVA GIS	URBAN	19.74
Total						**240.04**

3.5 Part-B – Construction of 33kv New Lines and Augmentation of existing Lines to improve Low voltage 33/11 KV PSS

The list of lines, quantum of length and cost of the same for implementation is given in the following table

Table 40: Augmentation oof 33 KV New Lines

Sl. no	Circle	Structure name	FROM	TO	Existing conductor size	Length (in KM)	Proposed conductor size	Costing (IN Cr)
1	BBSR-2	BINODPADA	Itamati	Binodpada	80	15	148	2.1
2	BBSR-2	HATABASTA						
3	Cuttack	Gopapur	Badamba	Gopapur	55/80/100	6.2	148	0.84
4	Cuttack	Dhobanala	Nuapatna Grid	Dhobanala	100	16	148	2.24
5	Cuttack	Badamba	Dhobanala	Badamba	100	6	148	0.84
6	Dhenken	Hindol Road	Panchpara Grid	Hindol Road	100	21	148	2.94
7	BBSR-2	DHALABANDHA	Khandapada	DHALABANDHA	55	8	148	1.12
8	BBSR-2	FATEGARH	T-off Dhalbandha	FATEGARH	55	19	148	2.66
9	BBSR-2	BIJIPUR	T-off Fategarh	BIJIPUR	55	0.65	148	0.091
10	BBSR-2	Kantilo	Khandapada	Kantilo	55	13	148	2.94
			TOTAL			**104.85**		**15.771**

3.6 Part C- Construction of 33kv New Lines from existing/ Proposed Grid

Table 41: Construction of 33 KV New Lines

Sl no	Circle	From	TO	Length (KM)	Conductor size	Structure name	Costing (in Cr)
1	BBSR-2	Shamuka Grid 4 pole	Brahmagiri	10	148	BRAHMAGIRI	3.4
2	BBSR-2					KHAJURIA	
3	BBSR-2					SUNAMUHIN	
4	BBSR-2					JAMALGADA	
5	BBSR-2					Panaspada	
6	BBSR-2	Baghmari PSS	Proposed 4P at Baghmari	0.2	148	GEDIAPALLI	0.1
7	BBSR-2					Baghmari	
8	BBSR-2					KALAPATHAR	
9	BBSR-2					BEGUNIA	
10	BBSR-2					PARICHHALA	
11	Paradeep	Existing Jagatsingpur Grid	Sova	30	232	BALIKUDA	11.4
12	Paradeep					SOVA	
13	Paradeep					DUVALO	
14	Dhenkenal	Rengali GRID	Kaniha	30	232	Kaniha	8.1
15						Hanumanpur	
16	Angul	Rengali GSS to.	33/11KV Khamar PSS	25	232	Khamar Kunjam Parbil Baruan	9
				95.2			32

3.7 Part-A- Construction of 33 KV/11 KV PSS

3.7.1 Srivihar (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Srivihar is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Srivihar s/s is planned from 132/33KV Chandaka-B grid S/s at a distance of 6 KMs. Four associated 11 kV feeders from Srivihar s/s with a total 11 kV linking of 2.3km (approx) divert loads from Kanan Vihar and CS pur-1 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 1700 consumers of KIIT CAMPUS-1,Part Of Sishu Vihar,Kanan Vihar Ph-2,Part Of Patia chowk, Sishu Vihar,Bajrang Vihar,SHREE VIHAR, Kanan vihar Ph-1,Patia with an anticipated load of 8 MVA.

- The Srivihar s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 24.38Crs.

2) <u>Introduction</u>

Installation of 2x8 MVA 33/11 kV substation at Srivihar with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) <u>Existing Scenario</u>

Presently the area namely KIIT CAMPUS-1,Part Of Sishu Vihar,Kanan Vihar Ph-2,Part Of Patia chowk, Sishu Vihar,Bajrang Vihar,SHREE VIHAR, Kanan vihar Ph-1,Patia is getting power supply from existing 33/11 kV Kanan Vihar and 33/11 kV CS pur-2 substation through KIIT, Kalarahanga, Patia 11 kV feeders respectively.

There are 4No's of outgoing 11 kV feeders emanating from Kanan Vihar substation namely KIIT feeder , Kalarahnaga feeder , Patia feeder, PKB feeder .

- KIIT 11 kV feeder having circuit length of 15.2 kMs (trunk and spur lines) carries 6.7 MVA peak load. It caters power supply to area such as Sishu Vihar, Bajrang Vihar.

- Sri Vihar 11 kV feeder having length of 21.9 kMs (trunk and spur lines) carries 5 MVA at its peak load. It caters power supply to Srivihar area.

- Patia 11 kV feeder of Kanan Vihar having length 15 kMs (trunk and spur lines) carries 6 MVA at its peak load. The feeder caters power supply to villages mainly Kanan vihar Ph-1,Patia Village .

Consumers in these areas are facing low voltage problem and frequent breakdowns due to lengthy feeder section & lower conductor size.

4) Need of the Project

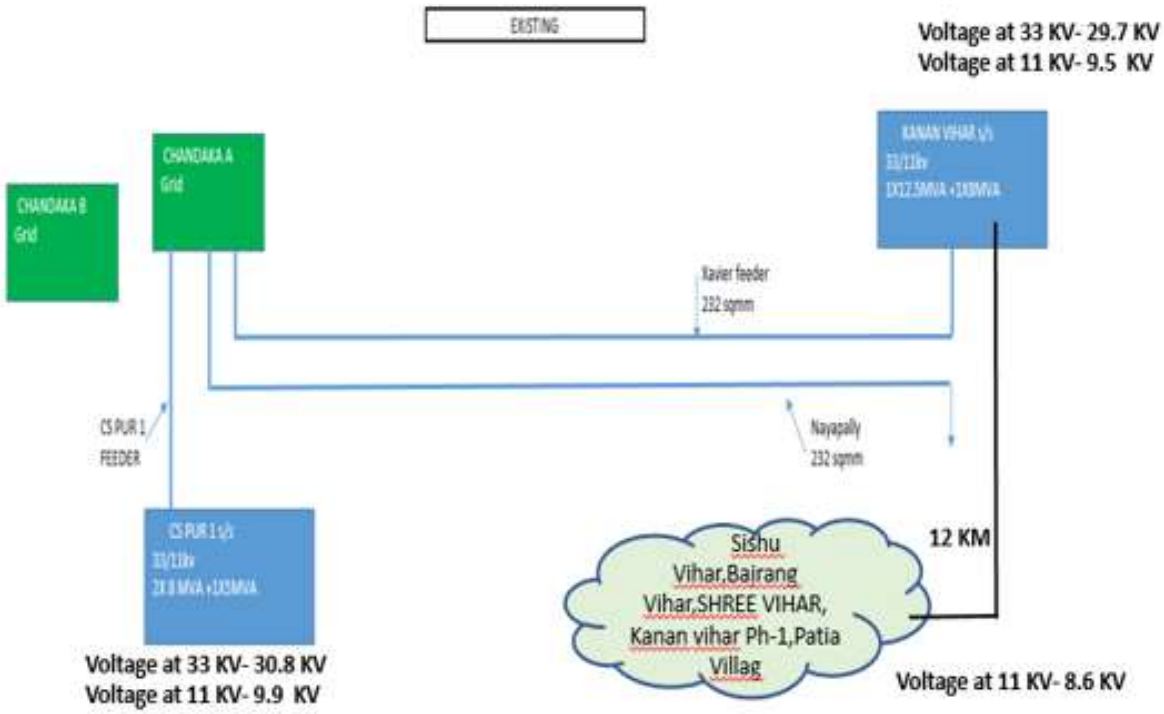
To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Srivihar with four numbers outgoing 11 kV feeders.

5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
SRIVIHAR (2X8 MVA)	SRI VIHAR	0.3	2	400
	IOCL OFFICE	0.5	2	1000
	INDUSTRIAL	1.2	2	200
	PATIA	0.3	2	100

6) Existing Scenario with SLD:-

Figure 7 Srivihar (2X8MVA) -Existing SLD



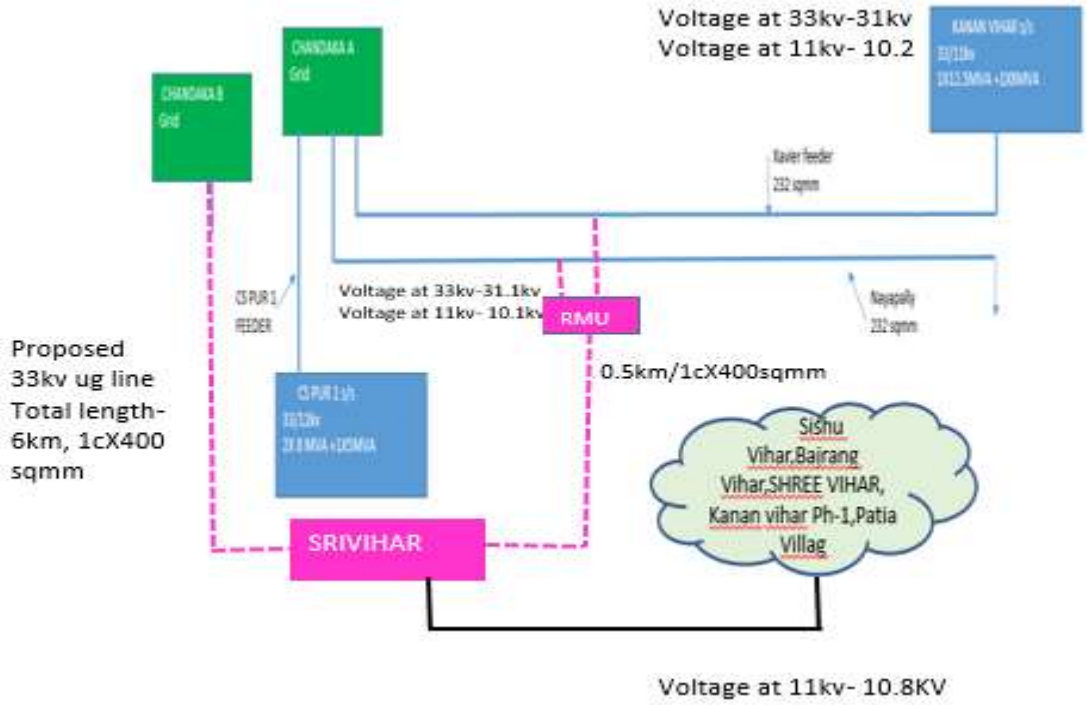
- 33/11 KV CS PUR 1 is connected through Cs pur 1 feeder from Chandaka A Grid .
- 33/11 KV Kanan vihar connected through 33 kv Xavier feeder from Chandaka A Grid .

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
CS PUR 1	CS PUR 1	30.8	9.9
XAVIER	KANANVIHAR	29.7	9.5

7) <u>Proposed Scenario with SLD: -</u>

- The proposed SRIVIHAR S/S to be connected from CHANDAKA B GRID at 6KM. 2.5 MVA load shifted from CS PUR 1 S/S to proposed SRIVIHAR S/S AND 2.5 MVA load shifted from kananvihar structure to proposed SRIVIHAR S/S. The Voltage will be improved to 11KV.

Figure 8 Srivihar (2X8MVA) -Proposed SLD



33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
CS PUR 1	CS PUR 1	31.1	10.1
XAVIER	KANANVIHAR	31	10.2
SRIVIHAR	SRIVIHAR	33.6	11

Recommendations: -

In order to achieve the permissible voltage at Srivihar, the following recommendations are to be taken into consideration:-

- Construction of New ug line of length 6KM with 33kv,1cx630mm2 ug cable from Chandaka A grid to Proposed Sri vihar(4.7km in HDD laying & 1.3km in Open Trench)
- Construction of New ug line of length 0.5KM with 33kv,1cx400mm2 ug cable from srivihar square to proposed Sri vihar S/S (0.6km in open trench) with istallation of 1nos, 33kv-3Way RMU for linking with existing 33kv Nayapalli & Xavier Feeder from Chandaka-A OPTCL grid.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X8 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work
- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with

100mm2 AAAC. Length = 0.5km

- Construction of 11kv ug line of length 1.8km with 11kv 3cx400mm2 ug cable.
- After implementing the above recommendations in the network, it is observed from the LF results that the voltage profile at proposed Sri vihar 33/11 kV s/s has been improved.
- Construction of OPTCL bay at Chandaka-B

8) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

9) Benefits

- Technical loss savings of 166kw on 33kv and 596KW on 11kv level.
- Improvement of voltage profile at the area around Srivihar
- Minimization of interruption.
- Reliability of power.
- Strengthening of distribution network.

10) Conclusion

The proposed s/s at Sri Vihar is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The budgetary cost estimate given in the DPR is a provisional one which may vary as per actual. The cost is as per approved rates and Capex rates. Rates of some of the items which are not available in the approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.2 Dhenkanal Town (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Dhenkanal Town is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Dhenkanal Town s/s is planned from dedicated feeder from 132/33KV Gundichapada grid S/s at a distance of 12 KMs. For n-1 redundancy, dedicated feeder at distance of 16Km from Khuntuni Grid is required. Four associated 11 kV feeders from Dhenkanal s/s with a total 11 kV linking of 4km (approx) divert loads from Colege 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 6000 consumers of Bajichowk chhaka, Housing Board Colony, Jaigopalsahi,Medical, Bus stand, collectorate, Talabania, Ganesh Bazar, Mahavir BazarKanjia, Biramchandra Pur,Talapada, Balisahi, Chandrakuta with an anticipated load of 6.2 MVA.

- The Dhenkanal s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 49.71 Crs.

2) Introduction

Installation of 2x8MVA 33/11 kV substation at Dhenkanal Town SS with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV College substation through Town-1 and Town 2 11 kV feeder feeding area Bajichowk chhaka,Housing Colony, Jaigopalsahi,Medical, Bus stand, collectorate, Talabania, Ganesh Bazar, Mahavir Bazar.

Consumers in these areas are facing low voltage problem and frequent break downs lengthy feeder section & lower conductor size.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Dhenkanal Town with Four numbers outgoing 11 kV feeders namely Balaram Mandir, Gandhi Mandir, Ganesh Bazar and Bus Stand.

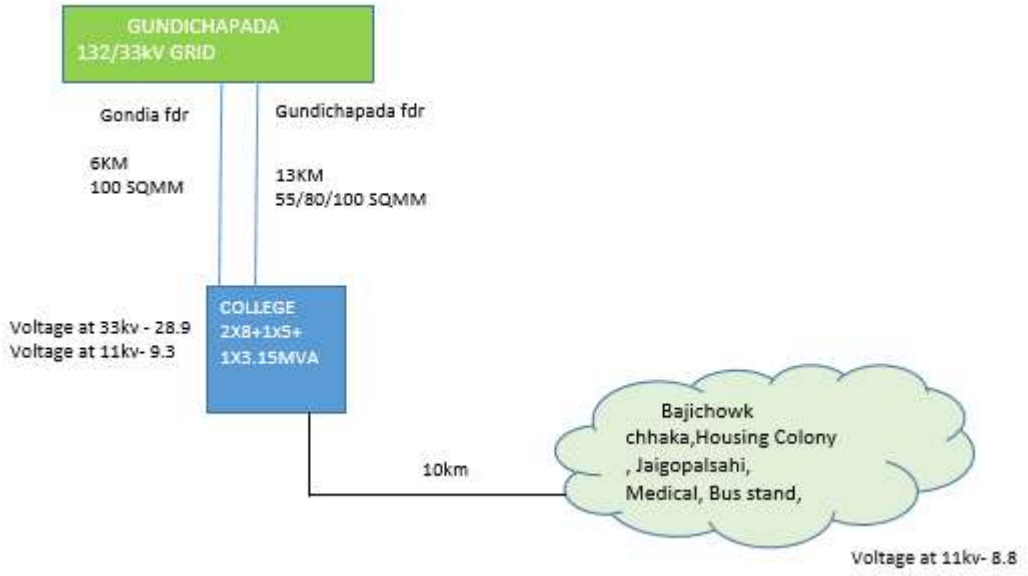
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Dhenkanal Town (2X8 MVA)	Balaram mandir	1	1.5	1500
	Gandhi Mandir	1	1.5	2500
	Ganesh Bazar	1	1.5	700
	Bus Stand	1	1.7	1300

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 9 Dhenkanal Town (2X8MVA) -Existing SLD

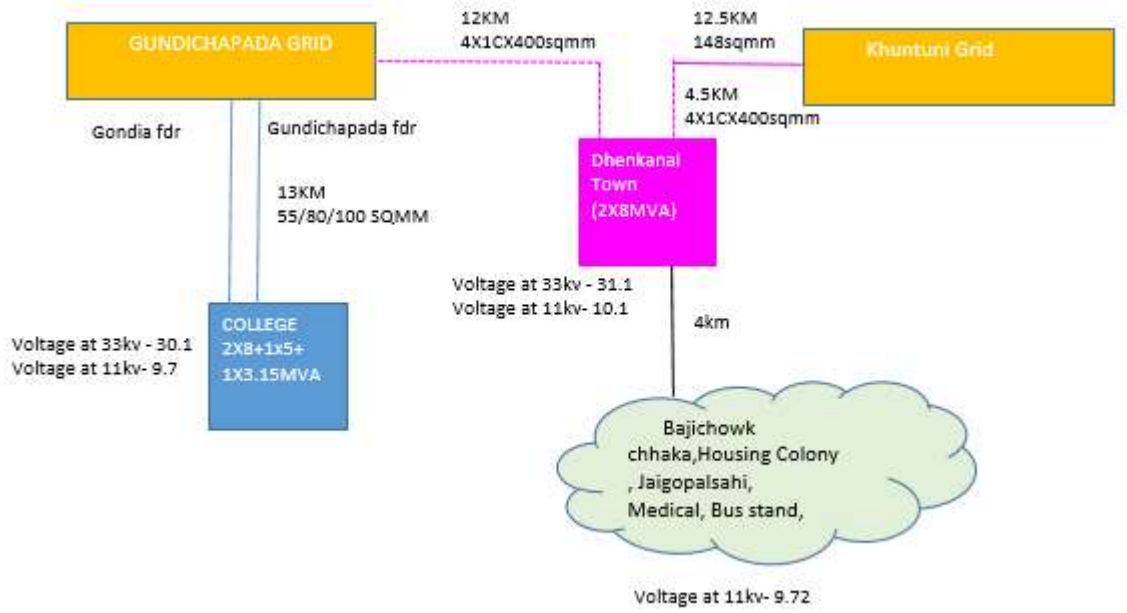


- College S/S connected from Dhenkenal Feeder of Gudiachapa Grid.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Dhenkanal	College	28.9	9.3

Proposed Scenario with SLD: -

Figure 10 Dhenkanal Town (2X8MVA) -Proposed SLD



- Dhenkanal Town S/S connected from proposed new line of Khuntuni Grid
- Dhenkanal Town S/S connected from proposed new line of Gundichapada Grid
- 6.2 MVA will be shifted from College PSS.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Dhenkanal	College	30.1	9.7
Dhenkanal Town	Dhenkanal Town	31.1	10.1

Recommendations: -

In order to achieve the permissible voltage at Dhenkanal Town area and reduce dependency on College SS, the following recommendations are to be taken into consideration:-

- Construction of 33 line using 13mtr WPB Pole with 148 sqmm- 12.5Ckm. and Construction of 33kv line UG (4X1CX400sqmm) with length appx. 4.5KM from Khuntuni Grid to Dhenkanal Town.
- Construction of 33kv line UG (4X1CX400sqmm) with length12 KM from Gundichapada Grid to Dhenkanal Town PSS.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss savings of 343KW on 33kv and 452KW on 11kv level.
- Improvement of voltage profile at the area around Dhenkanal Town Area
- Minimization of interruption.
- Reliability of power.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Dhenkanal Town is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.3 Panchmahal (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Panchmahal is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Panchmahal s/s is planned from 132/33KV Angul grid S/s at a distance of 9.5km. For n-1 redundancy, 33kv feeder will be laid from Meramundali Grid at a distance of 22.5KM. Four associated 11 kV feeders from Panchmahala s/s with a total 11 kV linking of 10.5km (approx) divert loads from RCMS 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 2200 consumers of Panchamahala, Saradhapur , Karadagadia,Rantelai , Hulurisingha, Panchamahala, Saradhapur, Gadataila, Talabahal, Badabahal, Kumursingha, Sabalabhanga, Balakata, Shyamasundarpur, Kariabani with an anticipated load of 6MVA.

- The Panchmahal s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 26.34Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Panchmahal with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV RCMS substation through 11 kV feeder Town -1 from RCMS PSS and Sabalbhanga feeder from Bantala PSS. Consumers in these areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Pachmahala with Four numbers outgoing 11 kV feeders named Panchmahala, Adarsh, Agriculture and Govt Polytechnic feeder.

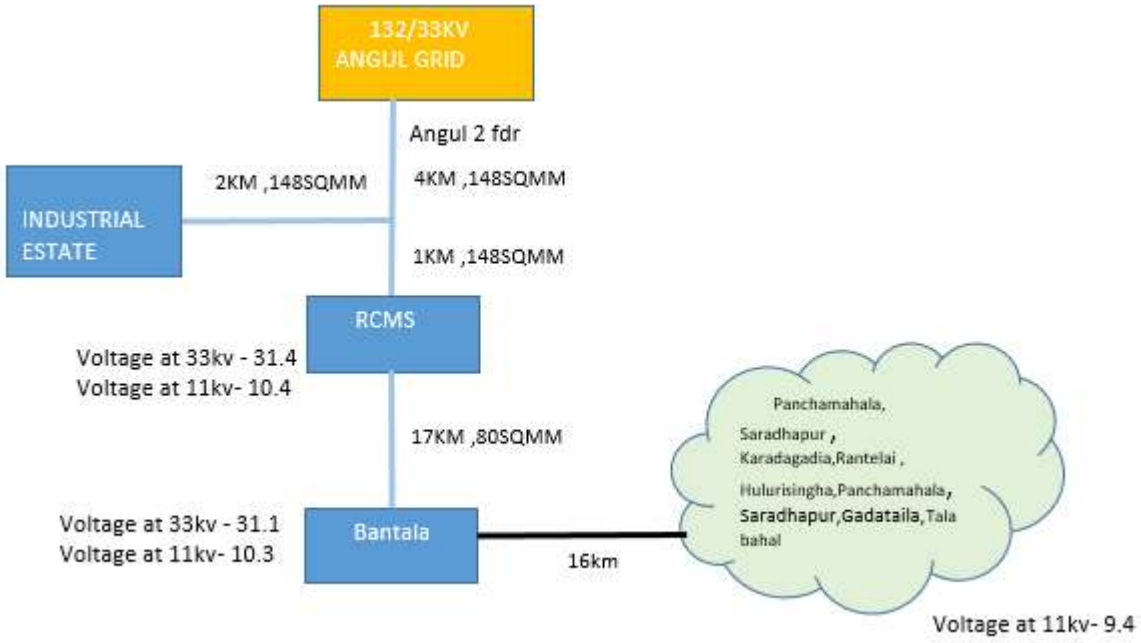
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Panchmahal (2X8 MVA)	Panchmahala	4	2	900
	Adarsh	2	2	900
	Agriculture	2	1.1	200
	Govt Polytechnic	2.5	0.9	200

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 11 Pacnhmahal (2X8MVA) Existing SLD

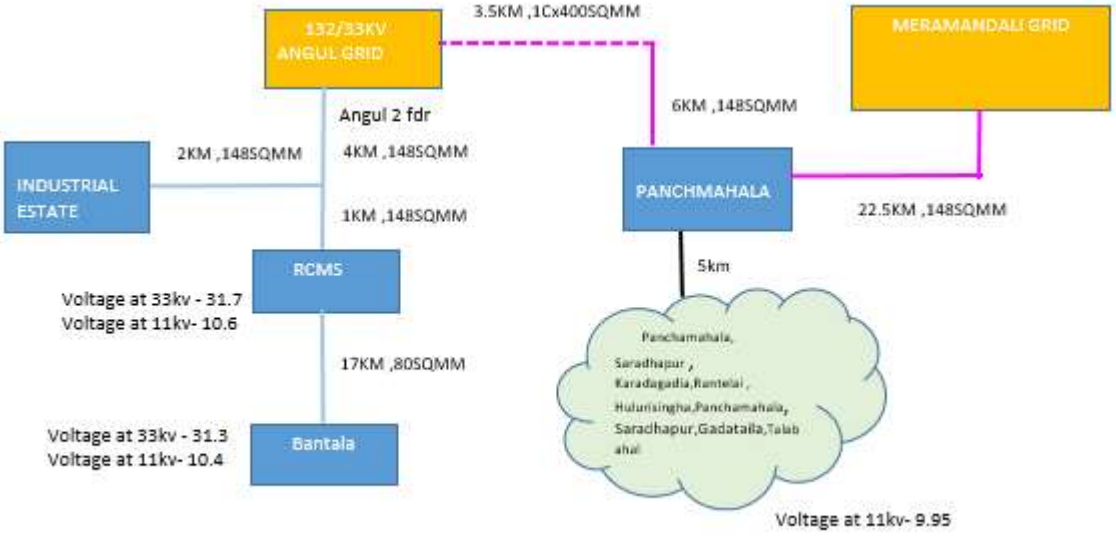


- RCMS S/S and Bantala S/S connected from Angul 2 Feeder of Angul Grid.
- All 11 KV and LT consumers, important installation in RCMS town area are getting supply from RCMS S/S and Bantala s/s .

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Angul 2	RCMS	31.4	10.4
Angul 2	BANTALA	31.1	10.3

Proposed Scenario with SLD: -

Figure 12 Pacnhmahal (2X8MVA) Proposed SLD



- Proposed Panchmala S/S connected from Angul Grid and Meramundali Grid.
- 6 MVA load will shift from RCMS S/S and Bantala S/S.
- The proposed Panchmahala S/S will Provide Reliable source for all 11KV and LT consumers.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
PANCHMAHALA	PANCHMAHALA	31.2	10.2
Angul 2	RCMS	31.7	10.6
Angul 2	BANTALA	31.3	10.4

Scope of Work: -

It is recommended for the following

- Construction of 33 line using 13mtr WPB Pole with 148 sqmm- 22.5km from Meramundali Grid to Panchmahal PSS
- Construction of 33 line using 13mtr WPB Pole with 148 sqmm- 6.8km. and Construction of 33kv line UG (4X1CX400sqmm) with length 3.5KM from Angul Grid to Panchmahla PSS
- Construction of 33/11 KV Primary Substation with 2X8 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work
- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with

100mm2 AAAC. Length(Panchamahala 11kV Feeder) = 4 km.

- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with 100mm2 AAAC. Length(Adarsa 11kV Feeder) = 2 km.
- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with 100mm2 AAAC. Length(Agriculture Feeder) = 2 km.
- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with 100mm2 AAAC. Length(Govt. Polytechnic 11kV Feeder) = 2.5 km.

- Tower for Lingarajodi Nala crossing=2Nos.
- Construction of OPTCL 33kv Bay at Angul Grid
- Construction of OPTCL 33kv Bay at Meramundali Grid

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical Loss savings of 48KW on 33kv and 203KW on 11kv level.
- N-1 redundancy for All important installation, 11KV and LT consumers
- Minimization of interruption.
- Strengthening of distribution network.
- Load shifting from RCMS and Bantala PSS

9) Conclusion

Proposed s/s at Panchmahala is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.4 Manguli (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Manguli is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Manguli s/s is planned from existing City Feeder from 132/33KV Choudwar grid S/s at a distance of 3.5KM. For n-1 redundancy, existing 33kv Tangi feeder will be tapped for a distance of 1km upto proposed SS. Three associated 11 kV feeders from Manguli s/s with a total 11 kV linking of 5km (approx) divert loads from Tangi 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 5550 consumers of Manguli (Ind.) , Nakhara & Kujibar , Napanga & Kesharpur , Sardola & Harianta. with an anticipated load of 4MVA.

- The Manguli s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 17.51 Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Manguli with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Tangi substation through 11 kV feeders. There are Five outgoing 11 kV feeder emanating from Tangi substation namely Manguli, Haripur, Bhatimunda, NH-5 and Local. Out of these, existing Manguli 11 kV feeder having length of 7KMs (trunk and spur lines) carries 4MVA at its peak load. It caters power supply to area such as Manguli (Ind.) , Nakhara & Kujibar , Napanga & Kesharpur , Sardola &

Harianta. Consumers in these areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Manguli with Three numbers outgoing 11 kV feeders namely Manguli, Kashipur and Naktara. Proposed Manguli 11kV feeder will cater loads to the villages mainly Manguli (Ind.) bus stand, etc. Proposed Kesharpur 11 kV feeder will cater loads to the villages Napanga & Kesharpur, etc. Proposed Nakhara 11kv feeder will cater load to Nakhara & Kujibar area. Total 3960 consumers will be benefitted.

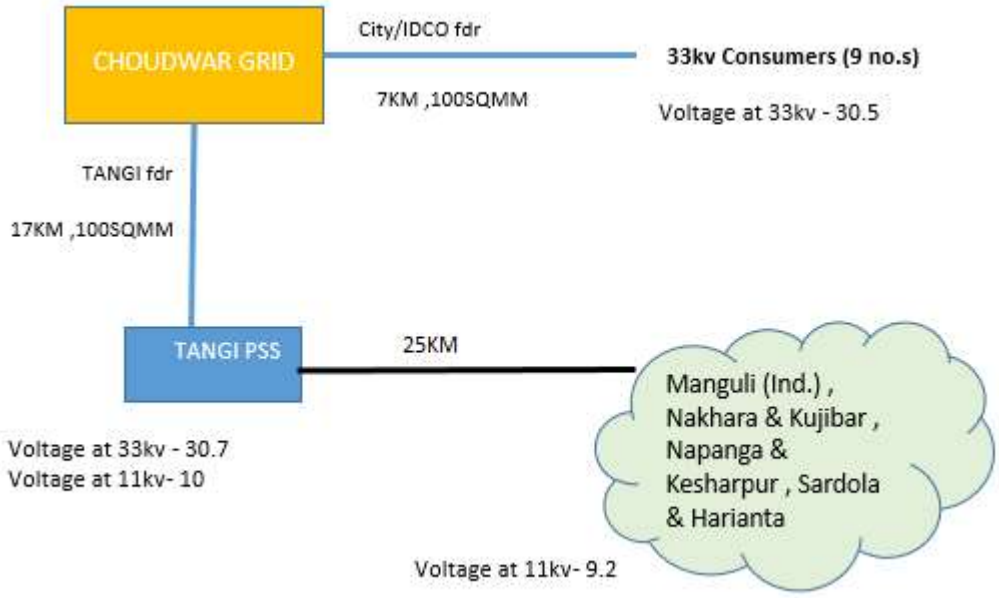
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Manguli (2X8 MVA)	Manguli	1	1.2	1250
	Kesharpur	2	2	830
	Nakhara	2	1	1880

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 13 Maguli(2X8MVA) Existing SLD

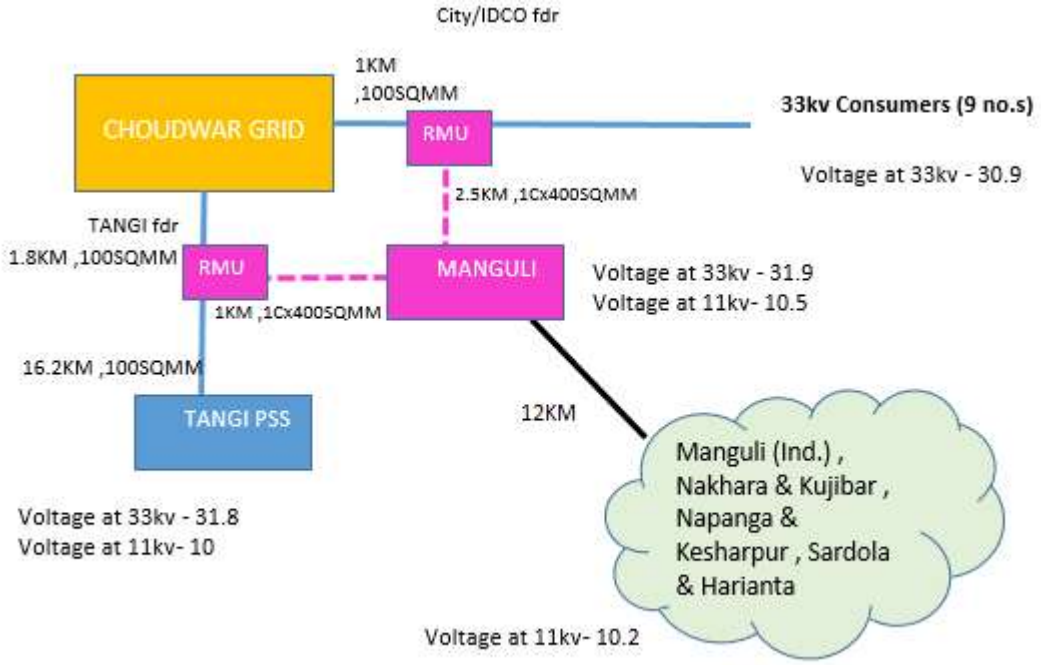


- Tangi S/S connected from Tangi Feeder from Choudwar Grid.
- 33 KV consumers in Tangi area are connected through City/IDCO feeder.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
TANGI	Tangi	30.7	10
IDCO	33 KV Consumer end	30.5	-

Proposed Scenario with SLD: -

Figure 14 Maguli(2X8MVA) Proposed SLD



33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Tangi	Tangi	31.8	10.1
IDCO	33 KV Consumer end	30.9	-
Tangi	Manguli	31.9	10.5

- Tangi S/S connected from from Choudwar Grid.
- 33 KV consumers in Tangi area are connected through IDCO feeder.
- Proposed Manguli S/S connected from Choudwar Grid via Tangi fdr and NOP on IDCO feeder.
- 3.2 MVA load to be shifted in proposed Substation from Tangi PSS.

Recommendations: -

- It is recommended to connect Choudwar Grid with Manguli S/S by construction of UG 4X1CX300 sqmm for 2.5km from Idco/City Feeder and 33kv 3W RMU installation. For n-1 redundancy Manguli S/S will be connected with existing 33kv Tangi Feeder by installation of 33kv 3W RMU and extending the feeder on UG (4X1CX400 sqmm) with distance 1Km.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss saving of 114kw on 33kv and 91kw on 11kv level
- N-1 redundancy for All important installations
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Manguli is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.5 Gadakan (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Gadakan is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Gadakan s/s is planned from dedicated feeder from Mancheswar A Grid at a distance of 1.5KM. For n-1 redundancy, existing Railway feeder 8 and 9 from Manchewar Grid is required at a distance of 1km upto proposed SS. Four associated 11 kV feeders from Gadakan s/s with a total 11 kV linking line of 2.5km divert loads from Sainik School 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 3500 consumers of Shakti Vihar, Gadakan, BMC Ray Project, Netaji Subash Bosh Enclave, Kendriya Vidyalaaya, Rangamatia with an anticipated load of 3.8MVA.

- The Gadakan s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 15.37 Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Gadakan with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Sainik School substation through 11 kV feeders namely Sainik School feeder. Consumers in tail end areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Gadakan with four numbers outgoing 11 kV feeders namely BMC EWS, BDA EWS, Subhash Enclave and Sangathan.

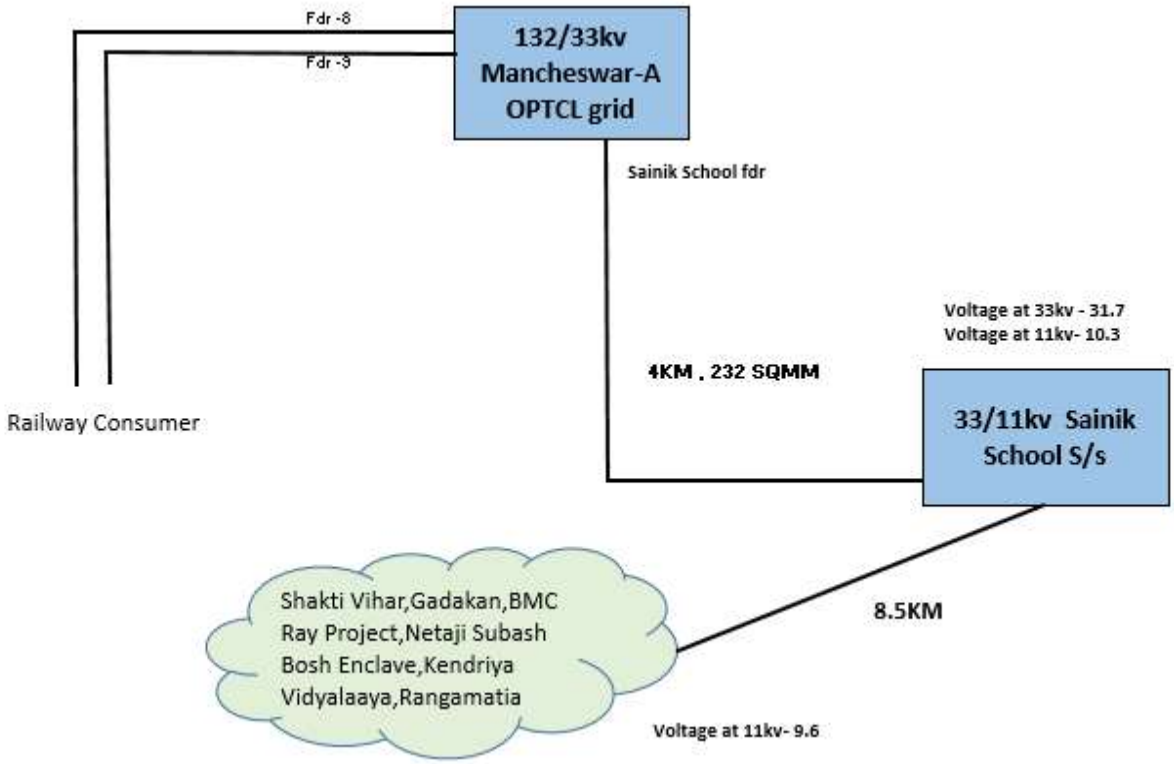
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Gadakan (2X8 MVA)	BMC EWS	0.7	0.5	1200
	BDA EWS	0.6	0.5	1350
	Subhash Enclave	0.6	0.5	400
	Sangathan	0.6	0.5	600

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 15 Gadakan(2X8MVA) Existing SLD

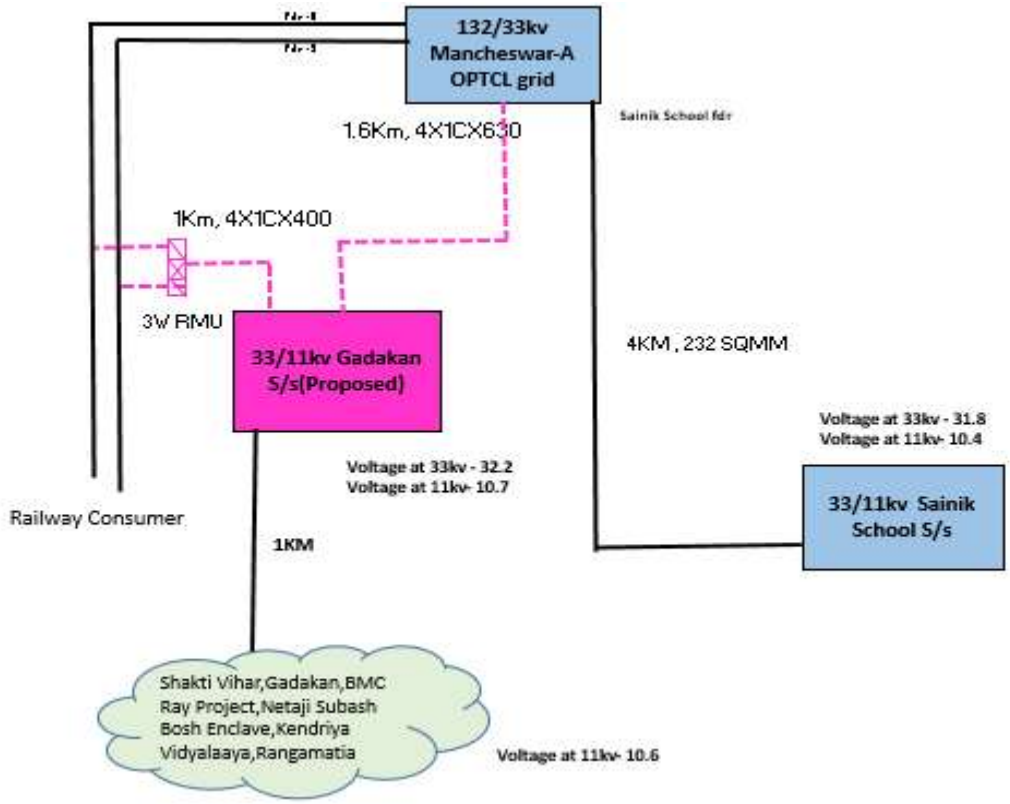


- Sainik school S/S connected from Sainik School Feeder of Mancheswar-A Grid

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Sainik school	33/11 KV Sainik school	31.7	10.3

Proposed Scenario with SLD: -

Figure 16 Gadakan(2X8MVA) Proposed SLD



33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Sainik school	Sainik school	31.8	10.4
Gadakan	Gadakan	32.2	10.7

- 33/11 KV proposed Gadakan structure is connected from Mancheswar A grid thru dedicated feeder and is NC.
- Gadakan is NOP from Railway fdr-8 and 9.
- 3.8 MVA load shifted from 33/11 KV sainik school to proposed 33/11 kv Gadakan structure.

Scope of Work: -

It is recommended for

- Construction of New ug line of length 1.6KM with 33kv,1cx630mm2 ug cable from Mancheswar A grid to Proposed Gadakan S/s (1km in HDD laying & 0.6km in Open Trench).
- Construction of New ug line of length 1KM with 33kv,1cx400mm2 ug cable with HDD laying & with installation of 1nos, 33kv-3Way RMU for linking of existing 33kv Feeder-8 & 9 from Mancheswar-A OPTCL grid.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X8 MVA

Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work).

- Construction of 11kv line over 11mtr long 160x160 ,30.44KG/MTR with 100mm2 AAAC.
- Construction of 11kv ug line of length 1.2km with 11kv 3cx400mm2 ug cable.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss saving of 19KW on 33kv and 192kw on 11kv level
- N-1 redundancy for All important installations
- Improved Voltage at tail end of Sainik School PSS
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Gadakan is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.6 Satasankha (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Satasankha is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Satasankha s/s is planned from 132/33KV Satasankha grid S/s at a distance of 7.92 KMs. with n-1 from Kumareswar PSS at distance of 1.48KM. Three associated 11 kV feeders from Satasankha s/s with a total 11 kV linking of 0.3km (approx) divert loads from Sakhigopal 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 4150 consumers of Kanjia, Biramchandra Puri, Talapada, Balisahi, Chandrakuta with an anticipated load of 2.85 MVA.

- The Satasankha s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 18.52 Crs.

2) Introduction

Installation of 2x8MVA 33/11 kV substation at Satasankha with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Sakhigopal substation through Satsankha 11 kV feeder. There are four outgoing 11 kV feeder emanating from Sakhigopal substation namely Sarangjodi, Satasankha, Sakhigopal, Express feeder. Satsankha 11 kV feeder having length of 50kMs (trunk and spur lines) carries 3.2 MVA at its peak load. It caters power supply to area such as Satsankha Bazar, Satsankha Village. Saraswati purGP, rathakrushnapur GP, Jasapur GP, Rupadeipur GP, Balanga GP, Chandradeipur GP, Uchhab pur

GP, Gopinathpur GP. Consumers in these areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Satasankha with Three numbers outgoing 11 kV feeders. Existing Satsankha 11 kV feeder will be converted to the following three new 11 kV feeder namely Teisipur, Bazar and Patnaika feeder. Proposed Teisipur 11kV feeder will cater loads to the villages mainly Teisipur, Birapurusottam Pur, Podanga, Praharajpur, Pidhapatna areas etc. Proposed Patnaika 11 kV feeder will cater loads to the villages Kanjia, BiramchandraPur, Talapada, Balisahi, Chandrakuta. Proposed Bazar 11 kV feeder will cater loads to the villages mainly Mahulia and Kasikiani.

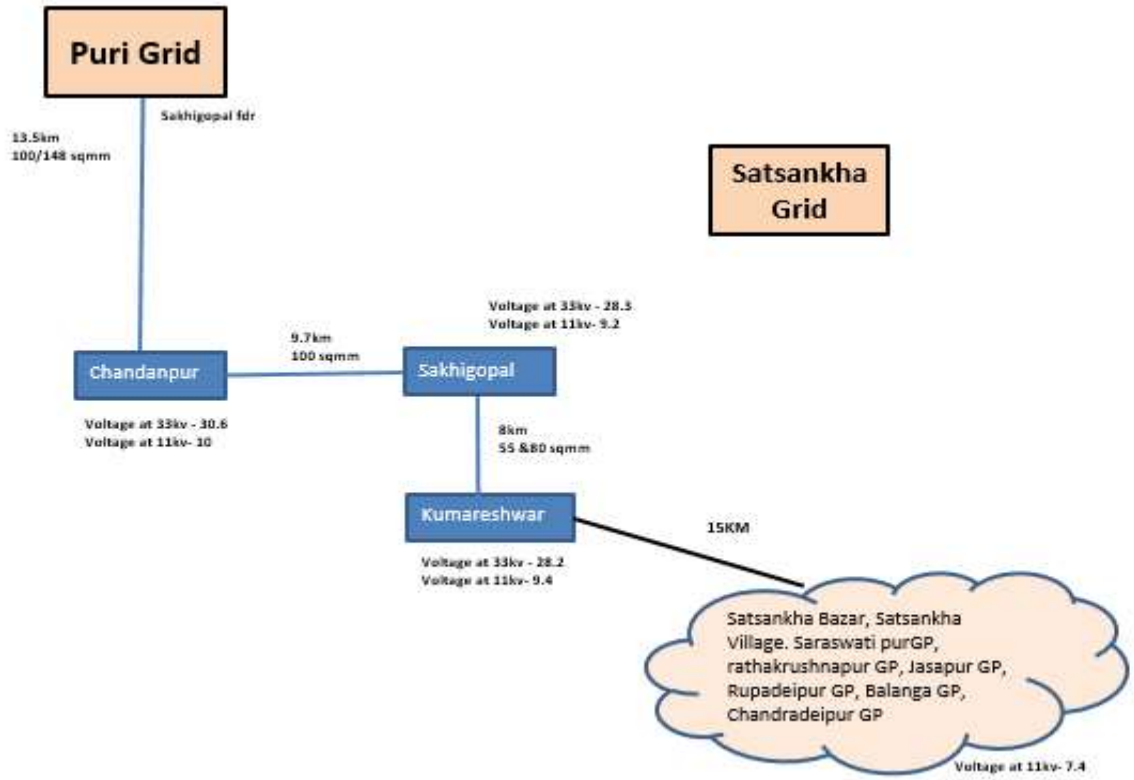
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Satasankha (2X8 MVA)	Teisipur	0.1	1.1	1500
	Bazar	0.1	0.57	1200
	Patnaika	0.4	1.1	1450

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 17 Sathasankha (2X8MVA) Existing SLD

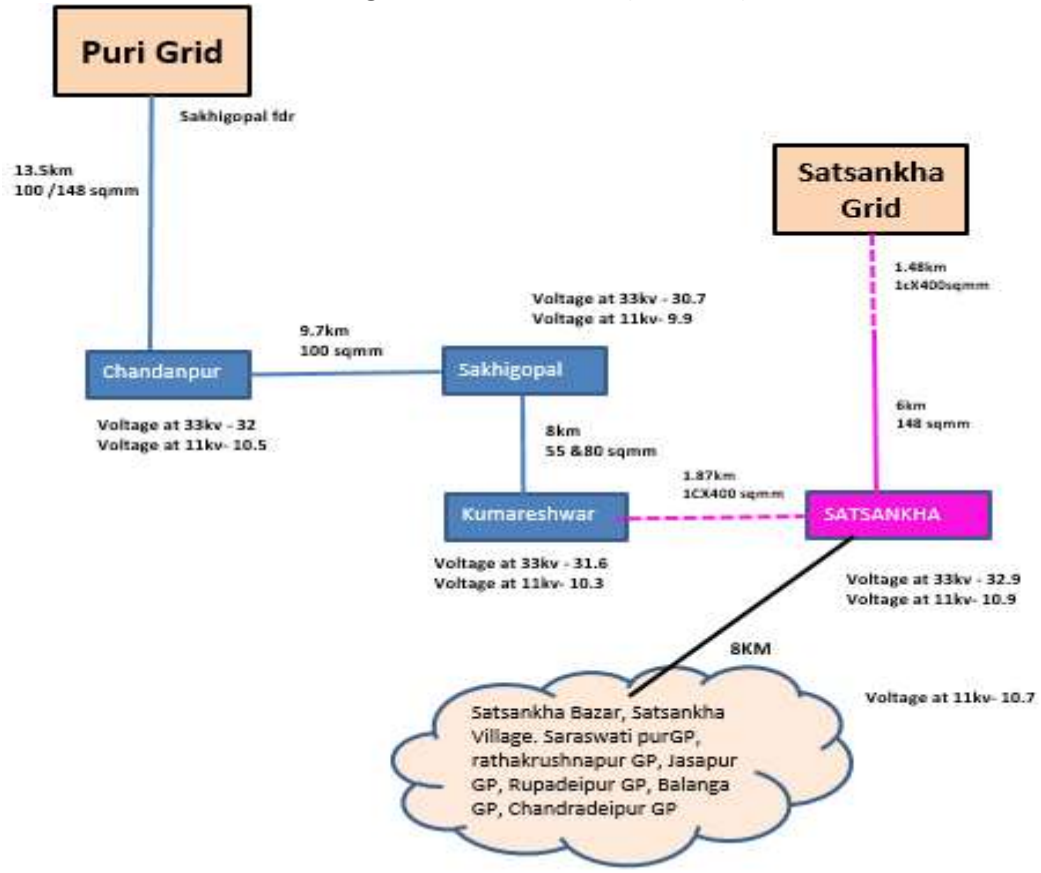


- 33/11 KV Satsankha/ Kumareswar is connected through Sakhigopal feeder from Puri Grid .

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Puri	SAKHIGOPAL	Chandanpur	30.6	10
Puri	SAKHIGOPAL	Sakhigopal	28.3	9.2
Puri	SAKHIGOPAL	Kumareswar	28.2	9.2

Proposed Scenario with SLD: -

Figure 18 Sathasankha (2X8MVA) New SLD



- Proposed Satasnkha S/S connected from Satsankha Grid as well as Puri Grid.
- 2.85 MVA load shifted from Sakhigopal S/S to Satsankha S/S.
- It is proposed to run Kumareshwar PSS on Proposed Satsankha Grid and Sakhigopal on existing Sakhigopal feeder.

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Puri	SAKHIGOPAL	Chandanpur	32	10.5
Puri	SAKHIGOPAL	Sakhigopal	30.7	9.9
Satsankha	Proposed Satsankha	Kumareswar	31.6	10.3
Satsankha	Proposed Satsankha	Satsankha	32.9	10.9

Recommendations: -

- In order to achieve the permissible voltage at Satsankha, the following recommendations are to be taken into consideration:-
- It is recommended to connect Thantahana/ Satsankha Grid with Satsankha S/S

by UG 4X1CX300 sqmm and 148 sqmm, AAAC conductor and then connect Satsankha S/S with existing Kumareshwar SS for n-1 redundancy to improve the voltage profile at Kumareshwar, Sakhigopal s/s.

- After implementing the above recommendations in the network, it is observed from the LF results that the voltage profile at proposed Satasankha 33/11 kV s/s has been improved.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss savings of 1220KW on 33kv and 630KW on 11kv level.
- Improvement of voltage profile at the area around Satsankha Bazar
- Minimization of interruption.
- Reliability of power.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Satasankha is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.7 Kajala (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Kajala is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Kajala s/s is planned from dedicated feeder from Duhuria Grid at a distance of 4.5KM. For n-1 redundancy, 33kv source from existing Kendrapada PSS will be tapped upto Kajala PSS at a distance of 0.2km. Four associated 11 kV feeders from Kajala s/s with a total 11 kV linking line of 5km divert loads from Kendrapada 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 3210 consumers of Uditnagar, kajala,Guhalsingh, Mahipal, Baniamal, Kasant with an anticipated load of 5.1MVA.

- The Kajala s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 23.33 Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Kajala with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Kendrapada substation through 11 kV feeders namely Town-1 and Tinamuhani feeder. Consumers in tail end areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Kajala with four numbers outgoing 11 kV feeders namely Brahmadipatna, Sujanagar, Baniamal and Thakurpatna.

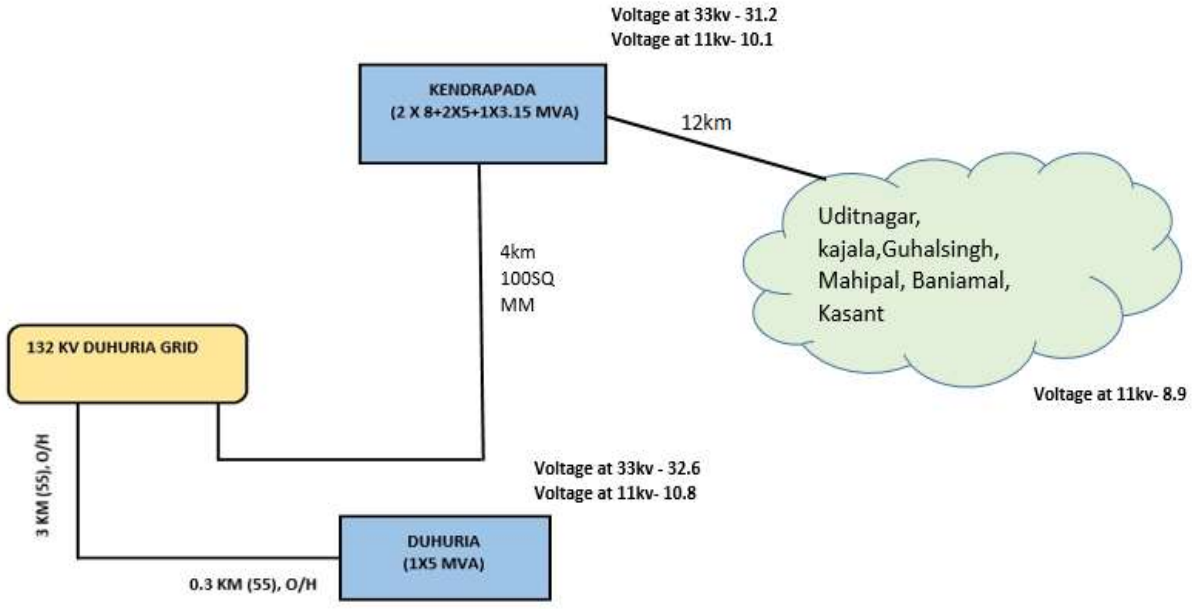
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Kajala (2X8 MVA)	Brahmadipatna	2	2	1100
	Sujanagar	1	1.5	1110
	Baniamal	1	1	500
	Thakurpatna	1	0.6	500

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 19 Kajala (2X8MVA) Existing SLD

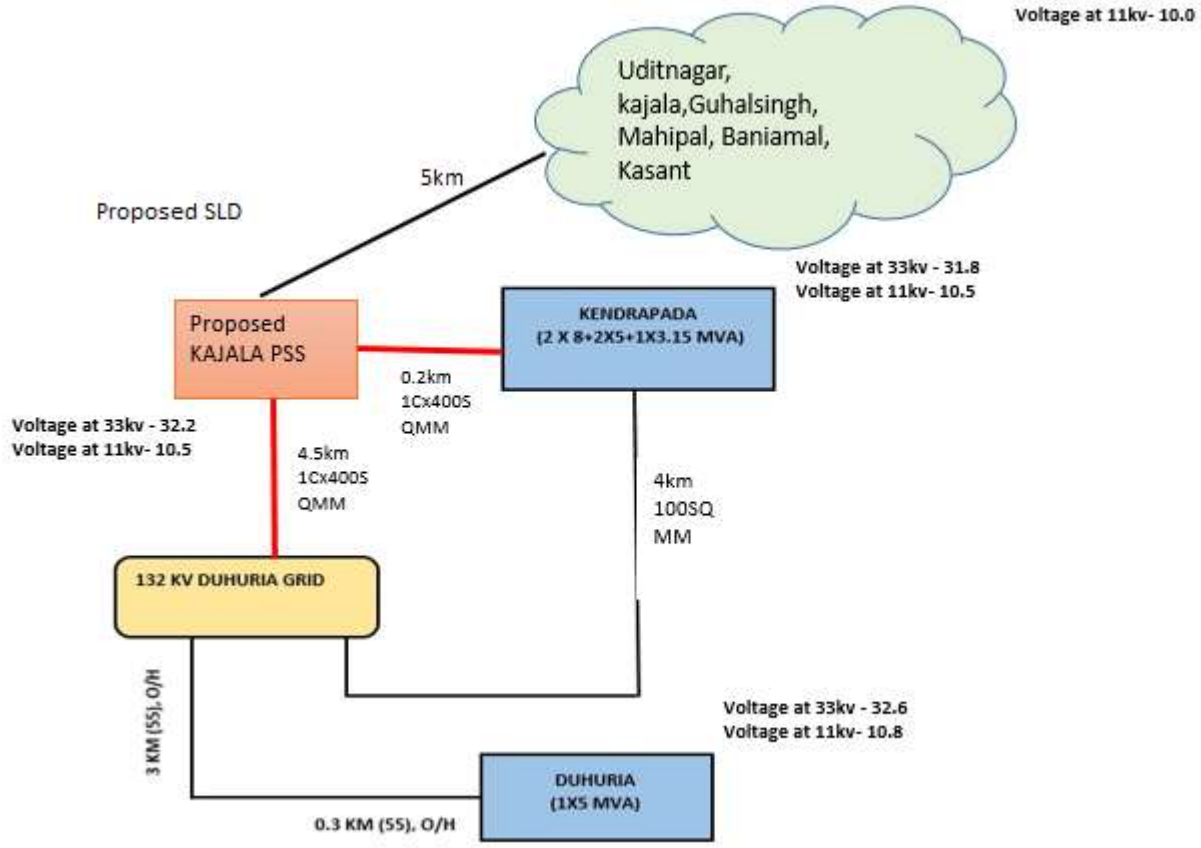


- Kendrapara S/S connected from Kendrapara Feeder of Duhuria Grid.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Kendrapara	Kendrapara	31.2	10.1
Duhuria	Duhuria	32.6	10.8

Proposed Scenario with SLD: -

Figure 20 Kajala (2X8MVA) Proposed SLD



33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Kendrapara	Kendrapara	31.8	10.5
Duhuria	Duhuria	32.6	10.8
	Kajala	32.2	10.5

- Kendrapara S/S connected from Kendrapara Feeder of Duhuria Grid.

- Proposed Kajala S/S connected through dedicated feeder from Duhuria Grid. It is proposed to connect Kajala for n-1 redundancy from Kendrapada feeder through Kendrapara PSS.

Scope of Work: -

It is recommended for

- Construction of 33kv line(U/G) of 4.5 km lentgh from Duhuria/Kendrapada Grid to proposed ODSSP KAJALA PSS. Construction of one number of 33KV Incomer DP with Isolator at Proposed KAJALA PSS.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X8 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work
- Construction of 01 No. 33 KV Bay at Kendrapada PSS for N-1 connectivity of Kajala ODSSP.
- Construction of 33kv line (U/G) of 0.2 km length from Kendrappada PSS to Proposed ODSSP KAJALA PSS for N-1 connectivity. Construction of one number of 33KV Incomer DP with Isolator at Proposed Manguli PSS.
- Construction of 11kv line(U/G) of 0.2 km using 3CX300 Sqmm XLPE with 01 No. spare run.for 04 Nos of 11 Kv feeder.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss savings of 202kw on 33kv and 147 kw on 11kv level.
- N-1 redundancy for All important installations
- Improved Voltage at tail end of Kendrapada PSS
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Kajala is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.8 Matiapala (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Matiapala is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Matiapala s/s is planned from dedicated feeder from Pattamundai Grid at a distance of 10KM. For n-1 redundancy, 33kv source from existing Sahupada feeder will be tapped upto Kajala PSS at a distance of 2km. Four associated 11 kV feeders from Kajala s/s with a total 11 kV linking line of 18.5km divert loads from Pattamundai 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 4500 consumers of Similia, Talapada,Khadianta, Osangara, Jigarana, Amber, Ainipada, Pachhapada, gangarampur with an anticipated load of 3.8MVA.

- The Matiapala s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 17.5 Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Matiapala with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Pattamundai substation through 11 kV feeders namely Jaria feeder. Consumers in tail end areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Matiapala with four numbers outgoing 11 kV feeders namely Tatana, Kakaruni, Pattamundai College and Amber feeder.

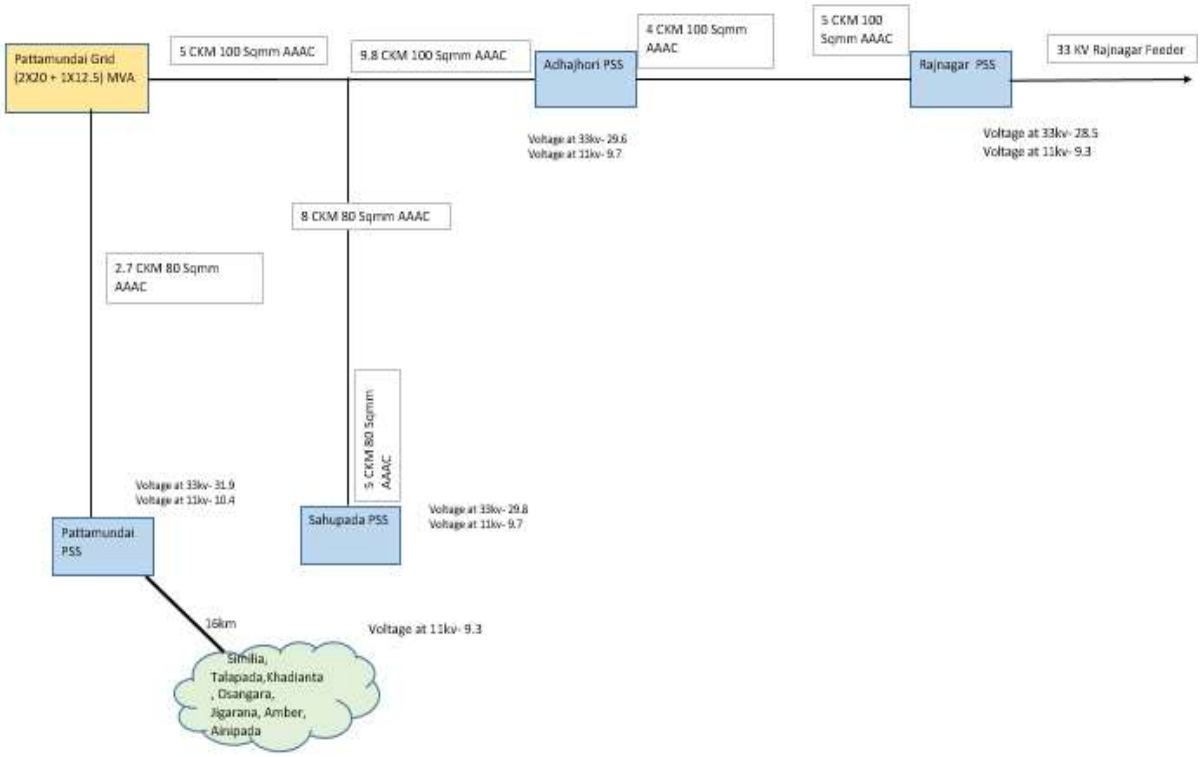
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Matiapala (2X8 MVA)	Tatana	1.2	0.8	2000
	Kakaruni	2.5	1.3	1800
	Pattamundai College	3.7	1	100
	Amber	4.7	0.7	600

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 21 Matiapala (2X8MVA) Existing SLD



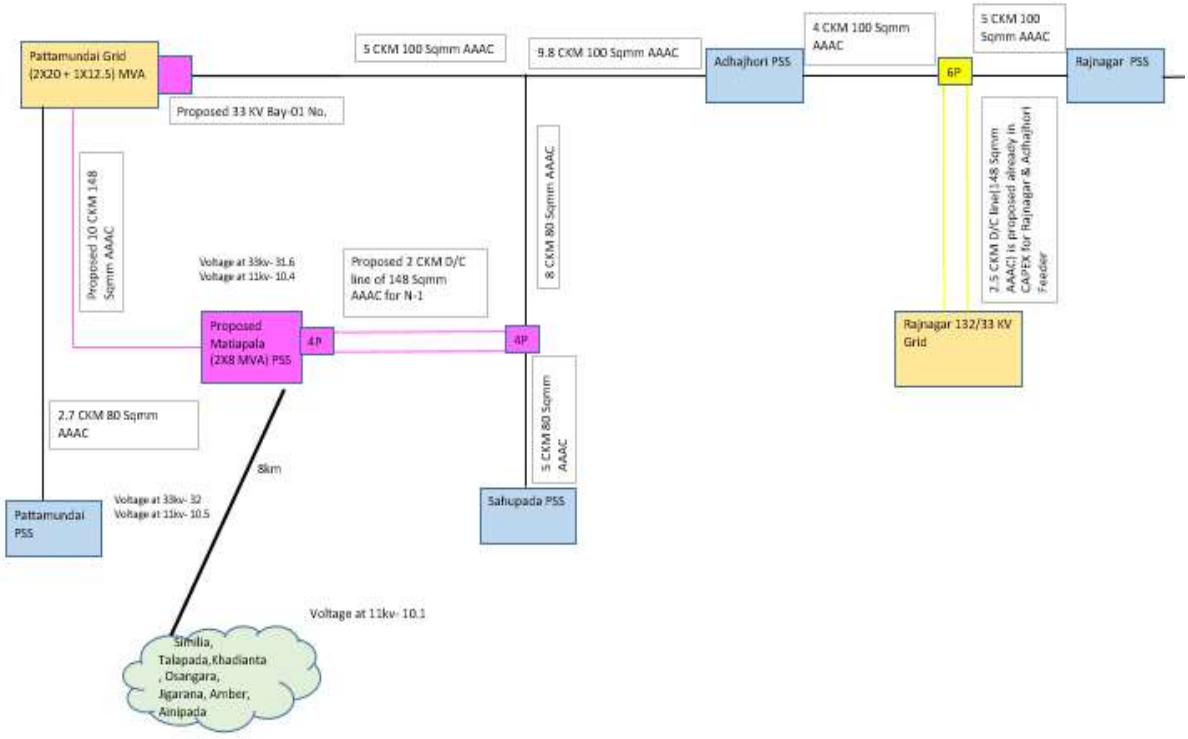
I. Pattamundai S/S connected from Pattamundai Feeder of Pattamundai Grid.

II. Sahupada S/S, Adhajori S/S, Rajnagar S/S and Kandira S/S connected from Rajnagar Feeder of Pattamundai Grid.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Pattamundai	Pattamundai	31.9	10.4
Rajnagar	Sahupada	29.8	9.7
	Adhajori	29.6	9.7
	Rajnagar	28.5	9.3

Proposed Scenario with SLD: -

Figure 22 Matiapala (2X8MVA) Proposed SLD



I.Proposed Matiapala S/S connected from proposed Matiapala Feeder of Pattamundai Grid and n-1 linking at proposed 4 Pole with Rajnagar feeder.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Pattamundai	Pattamundai	32	10.5
	Matiapala	31.6	10.4

Scope of Work: -

It is recommended for

- Construction of 01 NO. of 33 KV Line Bay at pattamundai 132/33 KV OPTCL Grid.
- Construction of 33kv line(O/H) of 10 ckm lentgh from Pattamundai Grid to proposed ODSSP Matiapala PSS.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X8 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work
- Constrcution of 33kv D/C line (O/H) of 2 ckm length from T-off of 33kv Rajnagar

feeder(Sahupada Part) near Kakharuni to Proposed ODSSP Matiapala PSS for N-1 connectivity.

- Construction of 11kv line of 18.5 ckm over 11mtr long,WPB Pole 160x160 ,30.44KG/MTR with 100mm2 AAAC. Total Nos of feeder-4 Nos.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical Loss 151kw on 11kv level.
- N-1 redundancy for All important installations
- Improved Voltage at tail end of Pattamundai PSS
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Matiapala is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items, which are not available in OERC, approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.9 Nabinabag (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Nabinabag is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Nabinabag s/s is planned from 132/33KV Khordha grid S/s at a distance of 2.1 KMs. For n-1 redundancy, existing 33kv Railway feeder will be tapped for a distance of 0.7km. Two associated 11 kV feeders from Nabinabag s/s with a total 11 kV linking of 0.4km (approx) divert loads from Khordha 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 2230 consumers of Gadakhordha, Panchasakha area, Nabinabag, Gandhipadia, New bus stand, etc with an anticipated load of 3.8 MVA.

- The Nabinabag s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 15.82Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Nabinabag with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Khordha substation through 11 kV feeders. There are Six outgoing 11 kV feeder emanating from Khordha substation namely Town-II, Panabaraj, Town-I, Gurujanga, Taratua and Medical. Town-II 11 kV feeder having length of 15.6KMs (trunk and spur lines) carries 3.9 MVA at its peak load. It caters power supply to area such as New bus stand, Bhaliabadi, Lokeshwarpur, Bikashnagar, Palla,

Konarknagar, Collectarate rd, Block office rd. Town-I 11kv feeder having length of 13.6km with Peak load of 2.13MVA caters power suplly to Managalanagar, BJB high school, SBI chhak, Municipilaty rd, Main rd, Kacheri, Sundaribara, Christiansahi. Consumers in these areas are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Nabinabagh with Two numbers outgoing 11 kV feeders. Existing Town-1and Town-2 11 kV feeder will be converted to the following two new 11 kV feeder namely Nabinabagh and Gadakhordha feeder. Proposed Nabinabagh 11kV feeder will cater loads (150A) to the villages mainly Nabinabag, Gandhipadia, New bus stand, etc. Proposed Gada Khordha 11 kV feeder will cater loads to the villages Gadakhordha, Panchasakha area, etc. Total 2230 consumers will be benefitted.

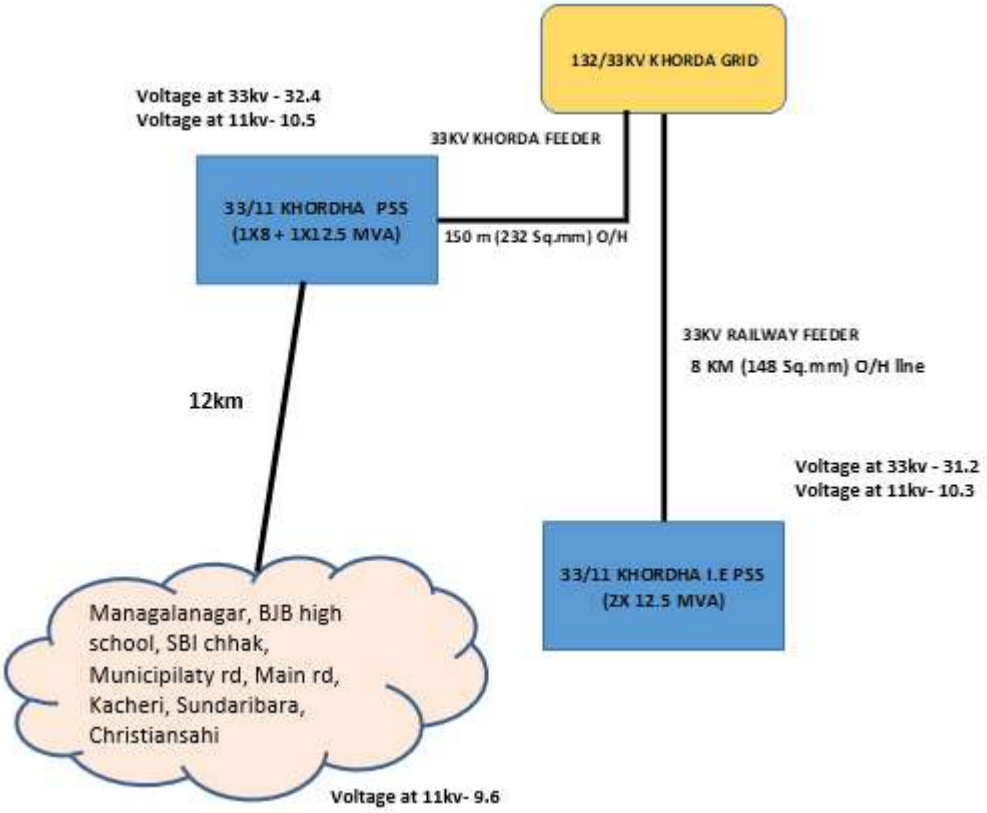
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Nabinabagh (2X8 MVA)	Nabinabagh	0.2	2.85	830
	Gada Khordha	0.2	0.95	1400

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

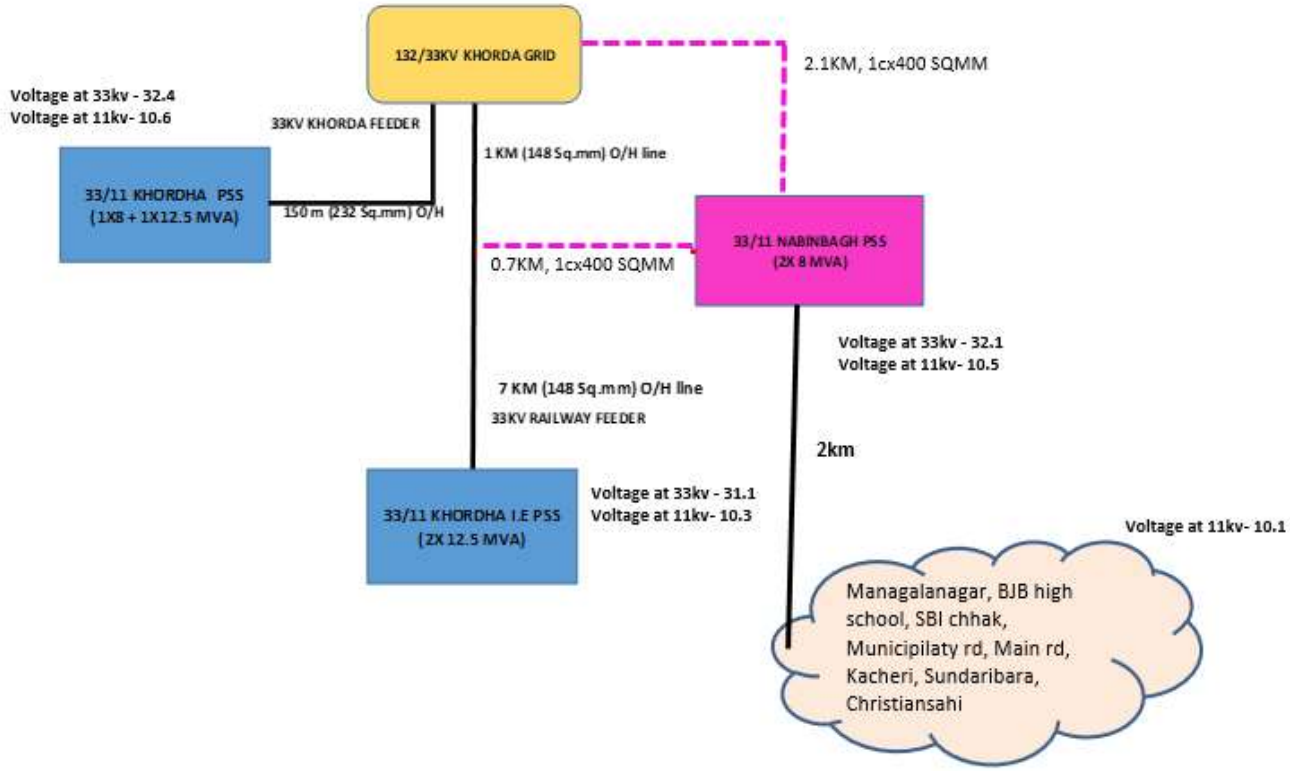
Figure 23 Nabinabag (2X8MVA) Existing SLD



- Khordha S/S connected from Khorda Feeder of Khorda Grid.
- All 11 KV and LT consumers, important installation in Khorda town area are getting supply from Khorda S/S.
- Khorda I.E Connected from Railway feeder of Khorda Grid.

Proposed Scenario with SLD: -

Figure 24 Nabinabag (2X8MVA) Proposed SLD



33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
RAILWAY	KHORDA I.E	31.1	10.3
KHORDA	KHORDA	32.4	10.6
RAILWAY	NABINBAGH	32.1	10.5

- Proposed Nabinabagh S/S connected from Khurda Grid.
- The proposed Nabinbagh S/S will Provide Reliable source for all 11KV and LT consumers of Khorda Town, Daleiput and Tapang area.

Recommendations: -

- It is recommended to connect Khorda Grid with Nabinabagh S/S by UG 4X1CX300 sqmm for 0.7km. For n-1 redundancy Nabinabagh S/S will be connected with existing 33kv Railway Feeder by installation of 33kv 3W RMU and extending the feeder on UG (4X1CX400 sqmm) with distance 0.7Km.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- N-1 redundancy for All-important installation, 11KV and LT consumers in Khorda town, daleiput and Tapang area.
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Nabinabagh is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.10 Sai Vihar (2X5MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Sai Vihar is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Sai Vihar s/s is planned from Tapping point of Bahugram of Choudwar Grid at a distance of 0.5KM. For n-1 redundancy, 33kv source from existing Jagatpur feeder will be tapped upto Sai Vihar PSS at a distance of 0.5km. Four associated 11 kV feeders from Sai Vihar s/s with a total 11 kV linking line of 8km divert loads from Jagatpur 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x5 MVA will cater loads to 5755 consumers of OIE, Najjarpur, Laxmanpur, Delta, Andhari, Fakirpur, Sikarpur, Panda Sahi, RHC, Trivenigada, Bhubanpur, Narayanbihar, Birupa Chawk with an anticipated load of 4MVA.

- The Sai Vihar s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 11.84 Crs.

2) Introduction

Installation of 2x5 MVA 33/11 kV substation at Sai Vihar with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Jagatpur substation through 11 kV feeders namely Old Industry. Consumers in tail end areas namely OIE, Najjarpur, Laxmanpur, Delta, Andhari, Fakirpur, Sikarpur, Panda Sahi, RHC, Trivenigada, Bhubanpur, Narayanbihar, Birupa Chawk are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Sai Vihar with four numbers outgoing 11 kV feeders namely OIE, Najjarpur, IB Road and Laxmivihar.

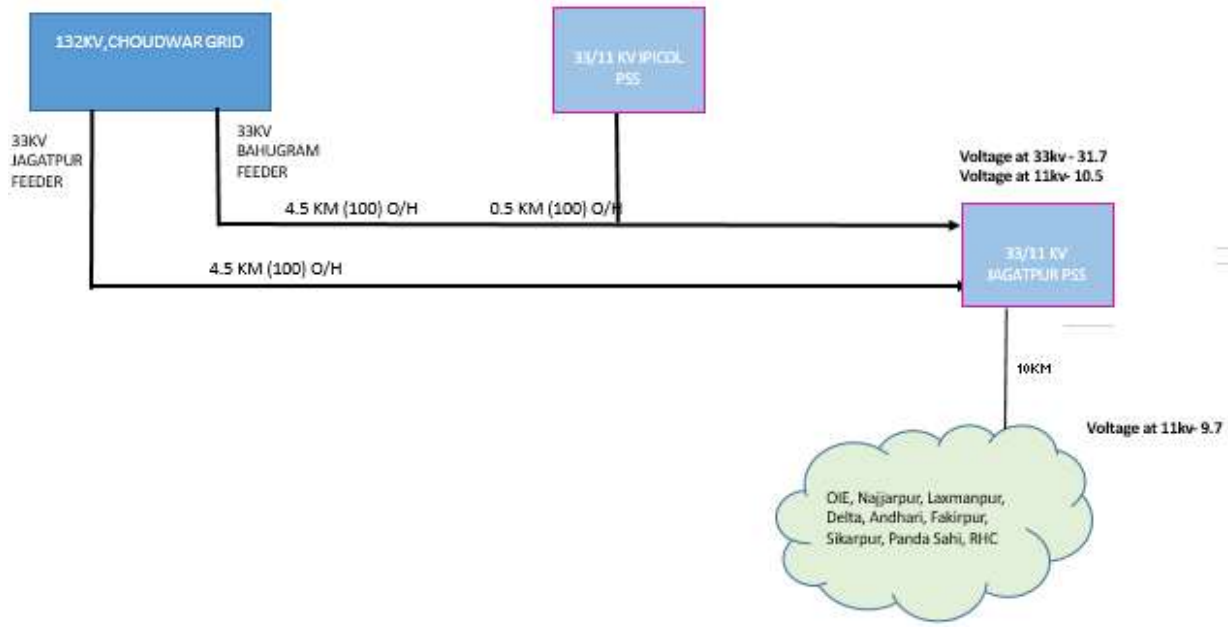
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Sai Vihar (2X8 MVA)	OIE	2	1	55
	Najjarpur	2	1	1500
	IB Road	2	1	2200
	Laxmivihar	2	1	2000

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 25 Sai Vihar (2X 5 MVA) Existing SLD

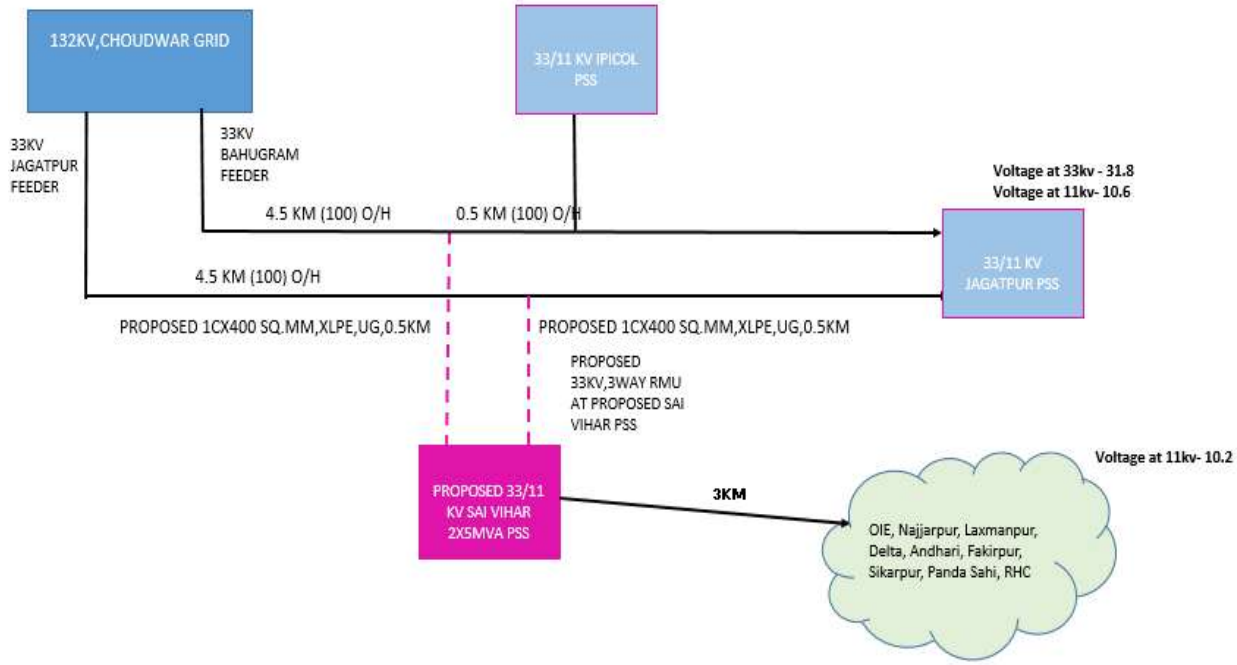


33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Jagatpur	Jagatpur	31.7	10.5

- Jagatpur S/S connected from Jagatpur Feeder of Choudwar Grid.

Proposed Scenario with SLD: -

Figure 26 Sai Vihar (2X 5 MVA) Proposed SLD



I.Jagatpur S/S connected from Jagatpur Feeder of Choudwar Grid.

II.Proposed Sai Vihar S/S connected from T-off of Jagatpur and Bahugram Feeder.

III.7MVA Load shifted from Jagatpur S/S to Sai Vihar S/S.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
Jagatpur	Jagatpur	31.8	10.6
	Sai Vihar	31.9	10.5

Scope of Work: -

It is recommended for

- Construction of 33kv line(U/G) of 0.5 km length with one 33KV,3WAY RMU from T-off of 33 KV Bahugram fdr. to proposed ODDSP SAI VIHAR PSS.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X5 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials, Labour, T&P etc. As per technical specification and scope of work
- Construction of 33kv line (U/G) of 0.5 km length from T-off of 33kv Jagatpur feeder to Proposed ODSSP Sai Vihar PSS for N-1 connectivity
- Construction of 11kv OH line of length of 8 Ckm over 11mtr long 160x160 ,30.44KG/MTR with 100mm2 AAAC.

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss saving of 168KW on 11kv level
- N-1 redundancy for All important installations
- Improved Voltage at tail end of Jagatpur PSS
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Sai Vihar is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x5 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.7.11 Meherpalli (2X8MVA)

1) Executive Summary:

The Proposal for installing of 33/11KV substation at Meherpalli is laid basing upon detailed Load Flow Analysis for existing loads in proposed area and catering low voltage issues through new Substation.

- The power supply to Meherpalli s/s is planned from Tapping point of Mancheswar- A Fdr 6 and at a distance of 0.15KM. For n-1 redundancy, 33kv source from existing Kesura Grid Fdr-1 will be tapped upto Maherpalli PSS at a distance of 0.15km. Three associated 11 kV feeders from Meherpalli s/s with a total 11 kV linking line of 10km divert loads from Laxmisagar and Kesura 33/11 kV s/s thereby ensuring uniform power distribution.

- The proposed substation with an installed capacity of 2x8 MVA will cater loads to 5600 consumers of Santoshi Vihar, Dalkhai , Koradakanta, and Jharpada with an anticipated load of 7MVA.

- The Meherpalli s/s, GIS Indoor will be SCADA enabled for smart operation with minimal human intervention in future.

- The total estimated cost for the proposed substation of Rs. 19.74 Crs.

2) Introduction

Installation of 2x8 MVA 33/11 kV substation at Meherpalli with associated 11 kV lines is required in order to supply reliable power in the area as well as to meet the increasing load demand due to prospective loads. The main thrust is laid on improvement of voltage profile, to minimize interruption of power supply to the consumers, availability of alternate power supply and socio-economic development of the inhabitants.

3) Existing Scenario

Presently the area is getting power supply from existing 33/11 kV Laxmisagar and Kesura substation through 11 kV feeders namely Laxmisagar, Jharpada and Kesura Village. Consumers in tail end areas namely Santoshi Vihar, Dalkhai , Koradakanta, and Jharpada are facing low voltage problem and frequent break downs due to snapping of conductors.

4) Need of the Project

To eradicate low voltage problem, improvement of supply system and to cater the future load growth it is proposed to install a 33/11 kV substation at Meherpalli with three numbers outgoing 11 kV feeders namely Jharpada New1, Laxmisagar New, mangaraj Point New.

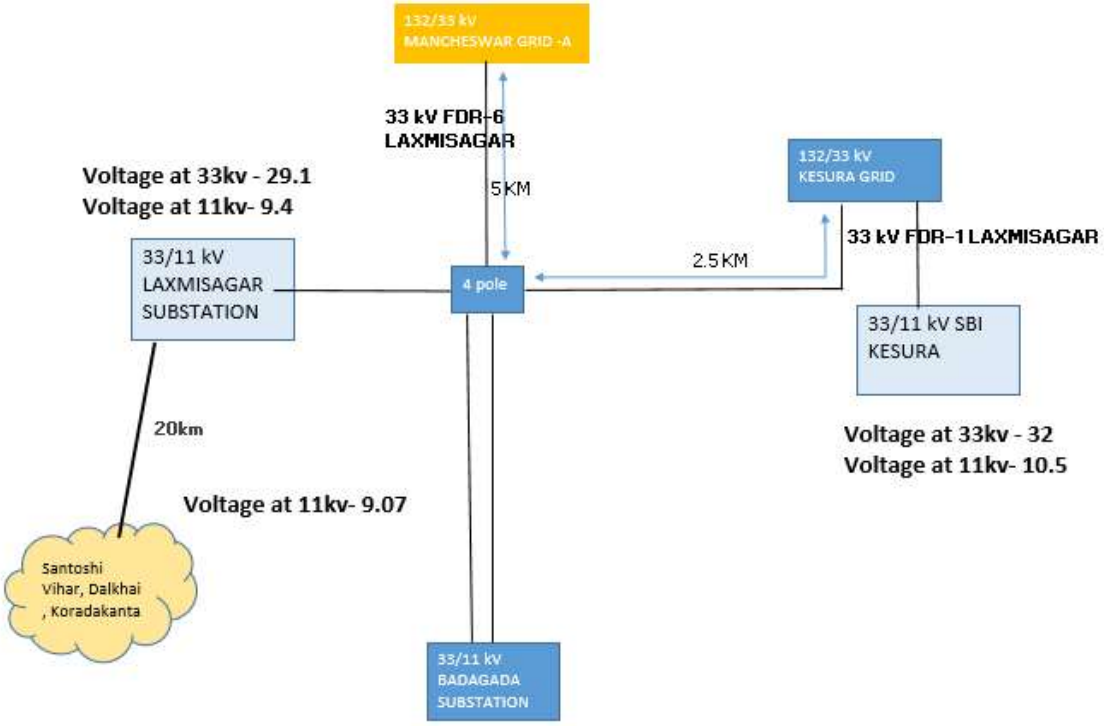
5) Load Details of the Proposed System:

Name of the proposed s/s	Name of the of proposed 11kV feeders	Length of feeder (km)	Anticipated load (MVA)	No. of consumers to avail supply from the feeder (Nos.)
Meherpalli (2X8 MVA)	Jharpada New 1	1	4	2100
	Laxmisagar New	1.5	2	1500
	Mangaraj Point New	2.5	1	2000

6) Load flow Analysis Results:-

Existing Scenario with SLD:-

Figure 27 Meharpalli (2X 8 MVA) Existing SLD

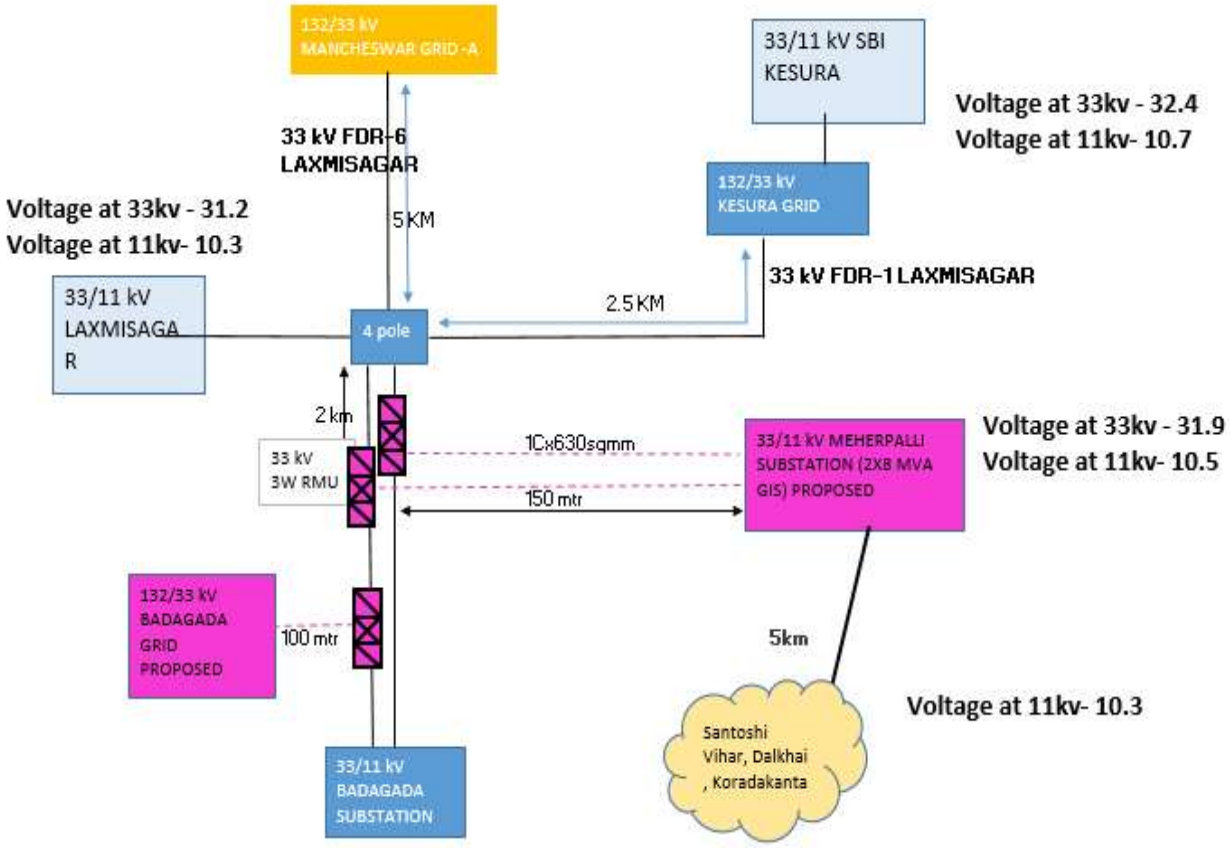


- Laxmisagar S/S connected from Fdr-6 of Mancheswar Grid.
- Kesura SS connected from Kesura fdr of Kesura Grid.

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
FDR 6	LAXMISAGAR	29.1	9.4
KESURA	KESURA	32	10.5

Proposed Scenario with SLD: -

Figure 28 Meharpalli (2X 8 MVA) Proposed SLD



I. Meherpalli S/S connected from Badagada as well as Fdr-6 of Mancheswar Grid and Fdr-1 of Kesura Grid
II. 7MVA load shifted from Laxmisagar and Kesura PSS.
III. Meherpalli will run from Badagada Grid

33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV	11 KV Bus Voltage in KV
FDR 6	LAXMISAGAR	31.2	10.3
KESURA	KESURA	32.4	10.7
	MEHERPALLI	31.9	10.5

Scope of Work: -

It is recommended for

- Laying of 33kv UG Cable 1Cx360sqmm for 0.4 km distance through open trench method with 3 nos of 33kv RMU .Length =0.4 km. Total no of 33 kV RMU=3.
- Construction of (36Mtr. X 34 Mtr.) 33/11 KV Primary Substation with 2X8 MVA Trf., including complete Control Room Building and All Equipment Supply, Erection, Commissioning, Testing, Civil Works with supply of all materials,

Labour, T&P etc. As per technical specification and scope of work

- Laying of 11kv UG Cable 3Cx400sqmm for 5 km distance through open trench method with 3 nos of 11kv RMU Length =5 km. Total no of 11kv feeders=3.
- Construction of Line DP with AB switch (2 nos)

7) Cost Estimate

The detailed cost estimates have been given in **Annexure 7- BOQ of Scheme for addressing Low Voltage**

8) Benefits

- Technical loss savings of 150kw on 33kv and 505 kw on 11kv level
- N-1 redundancy for All important installations
- Improved Voltage at tail end of Laxmisagar PSS and Kesura PSS
- Minimization of interruption.
- Strengthening of distribution network.

9) Conclusion

Proposed s/s at Meherpalli is necessary after considering the length of 11 kV feeder and poor voltage profile which caters power supply to the subject areas. Based on the present and future load growth, installation of 2x8 MVA s/s GIS Indoor is proposed along with SCADA compatibility. The cost is as per OERC approved rates and Capex rates. Rates of some of the items which are not available in OERC approved rates and Capex rates are considered from Competitive Market prices, SCRIPS. The BoQ and Cost estimate of 33/11 kV s/s (GIS Indoor), 33 kV line and 11 kV line are finalized in consultation with NEG, STS , Projects and Division.

3.8 Part-B – Construction of 33kv New Lines and Augmentation of existing Lines to improve Low voltage 33/11 KV PSS

Conductor Augmentation

The summary of conductor replacement is as given in the table below:

Table 42: Augmentation of 33 KV New Lines

Sl. no	Circle	Structure name	FROM	TO	Existing conductor size	Length (in KM)	Proposed conductor size	Costing (IN Cr)
1	BBSR-2	BINODPADA	Itamati	Binodpada	80	15	148	2.1
2	BBSR-2	HATABASTA						
3	Cuttack	Gopapur	Badamba	Gopapur	55/80/100	6.2	148	0.84
4	Cuttack	Dhobanala	Nuapatna Grid	Dhobanala	100	16	148	2.24
5	Cuttack	Badamba	Dhobanala	Badamba	100	6	148	0.84
6	Dhenkan	Hindol Road	Panchpara Grid	Hindol Road	100	21	148	2.94
7	BBSR-2	DHALABANDHA	Khandapada	DHALABANDHA	55	8	148	1.12
8	BBSR-2	FATEGARH	T-off Dhalbandha	FATEGARH	55	19	148	2.66
9	BBSR-2	BIJIPUR	T-off Fategarh	BIJIPUR	55	0.65	148	0.091
10	BBSR-2	Kantilo	Khandapada	Kantilo	55	13	148	2.94
			TOTAL			**104.85**		**15.771**

The Proposals for Conductor Replacement are as below:-

3.8.1 Augmentation of existing Conductor from Itamati PSS to Binodpada PSS

- **Existing Scenario-**

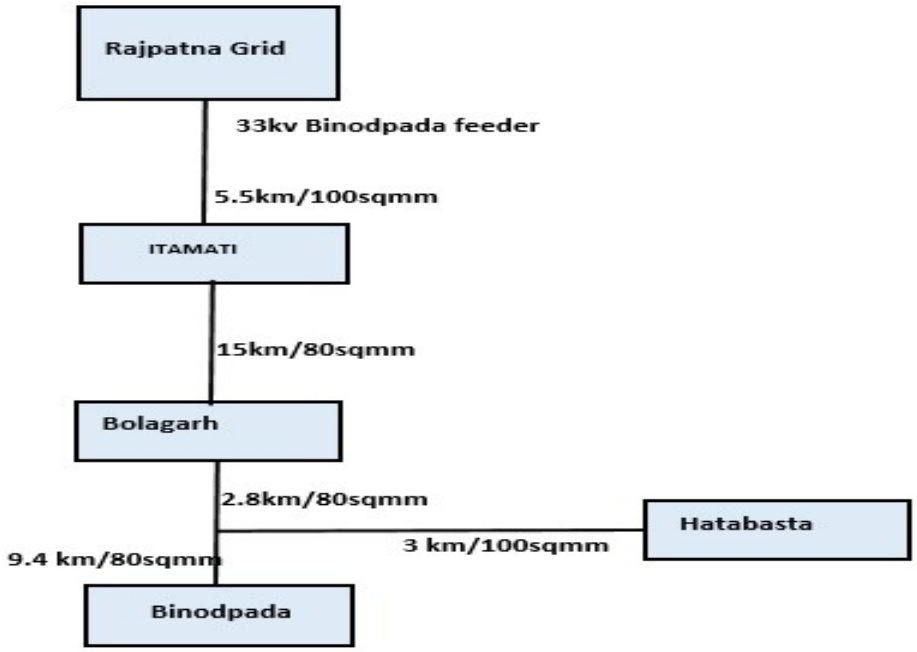
Existing 33kv Binodpada feeder emanating from Rajpatna Grid currently feeding Itamati PSS, Bolagarh PSS and Binodpada PSS . The feeder total length 23.3Ckt Km. The loading of PSS is 16 MVA.

The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rajpatna	Binodpada	Binodpada	28.2
Rajpatna	Binodpada	Hatabasta	30

In existing feeder, the section between Itamati PSS and Bolagarh PSS is having 80sqmm conductor for length of 15Ckt Km . As the conductor is undersized, there is low voltage condition persisting on tail end of feeder. Binodpada and Hatabasta are receiving lower voltage (<9% voltage drop).

Figure 29: Existing SLD: Itamati PSS to Binodpada PSS



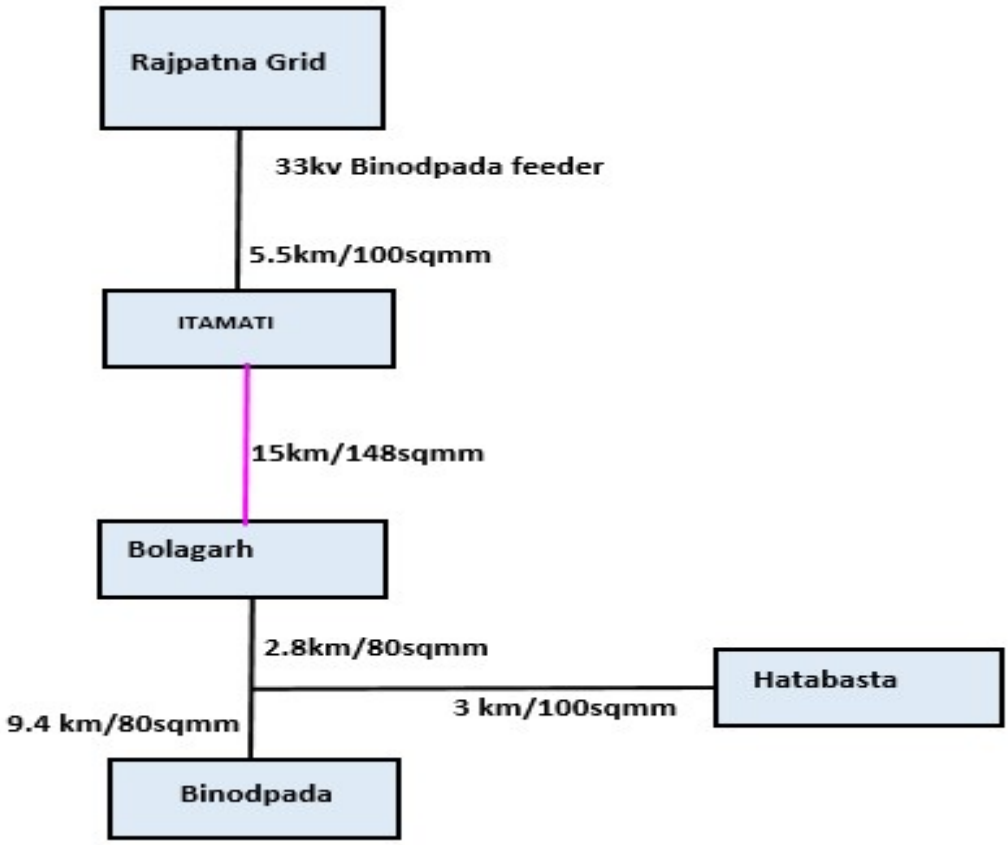
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Binodpada and Hatabasta PSS, it is proposed to augment existing conductor size from 80sqmm to 148sqmm between Itamati PSS to Bolagarh PSS which will improve the voltage at Binodpada PSS & Hatabasta PSS. At Binodpada PSS, it is proposed to change the Power TRF HT Side Tap to maintain 11KV Bus voltage at PSS. The Voltages improve to as follows

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rajpatna	Binodpada	Binodpada	29.1
Rajpatna	Binodpada	Hatabasta	30.1

- **Proposed SLD**

Figure 30: Proposed SLD: Itamati PSS to Binodpada PSS



- **Benefits**

1) Low voltage problem will be solved at Binodpada PSS & Hatabasta PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve.

3.8.2 Badamba PSS to Gopapur PSS

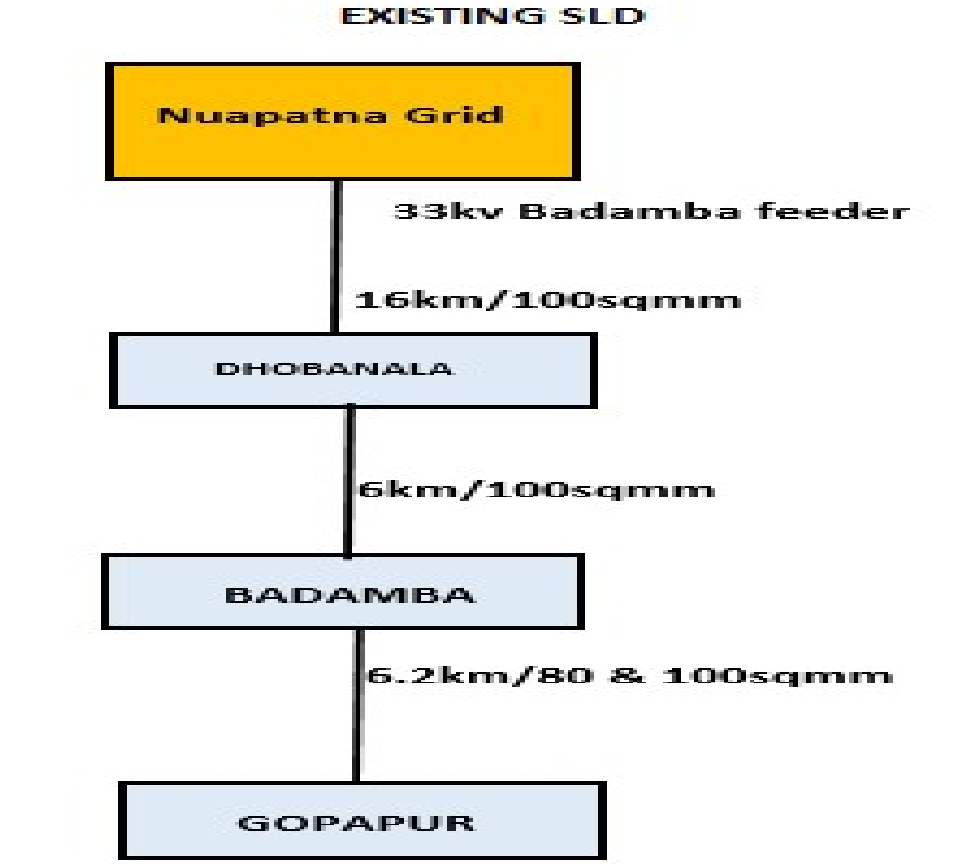
Existing 33kv Badamba feeder emanating from Nuapatna Grid currently feeding Dhobanala PSS, Badamba PSS and Gopapur PSS. The feeder total length 28.2 Ckt Km. The peak load of feeder is 11MVA

The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	28.2
Nuapatna	Badamba	Badamba	28.6
Nuapatna	Badamba	Dhobanala	29.5

In existing feeder, the section between Badamba PSS and Gopapur PSS is having 80&100 sqmm conductor for length of 6.2 Ckt Km . As the conductor is undersized, there is low voltage condition persisting on tail end of feeder. Gopapur, Badamba and Dhobanala are receiving lower voltage (<9% voltage drop).

Figure 31: Existing SLD: Badamba PSS to Gopapur PSS



- **Proposal to mitigate low voltage -**

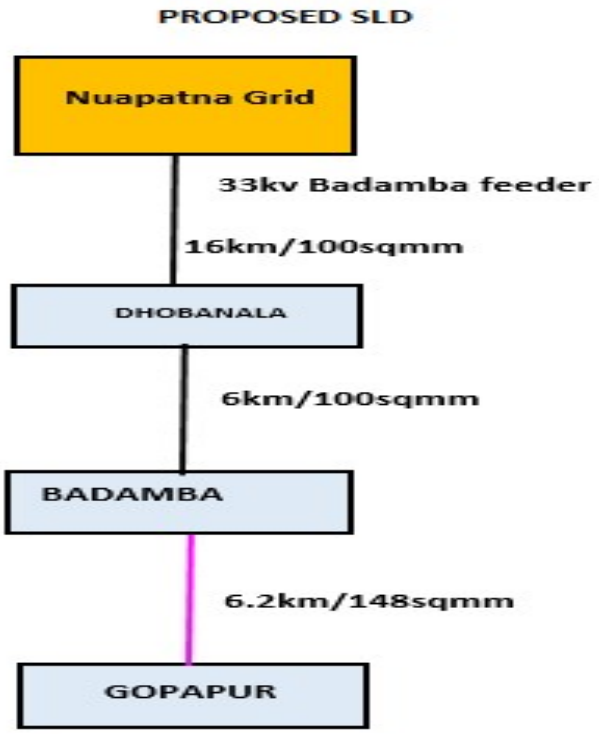
To mitigate the low voltage on Gopapur PSS, it is proposed to augment existing conductor size from 80&100sqmm to 148sqmm between Badamba PSS to Gopapur PSS which will

improve the voltage at Gopapur PSS. At Gopapur PSS, it is proposed to change the Power TRF HT Side Tap to maintain 11KV Bus voltage at PSS..

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	29.4
Nuapatna	Badamba	Badamba	28.6
Nuapatna	Badamba	Dhobanala	29.5

- **Proposed SLD**

Figure 32: Proposed SLD: Badamba PSS to Gopapur PSS



- **Benefits**

1) Low voltage problem will be solved at Gopapur PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve.

3.8.3 Nuapatna Grid to Dhobanala PSS

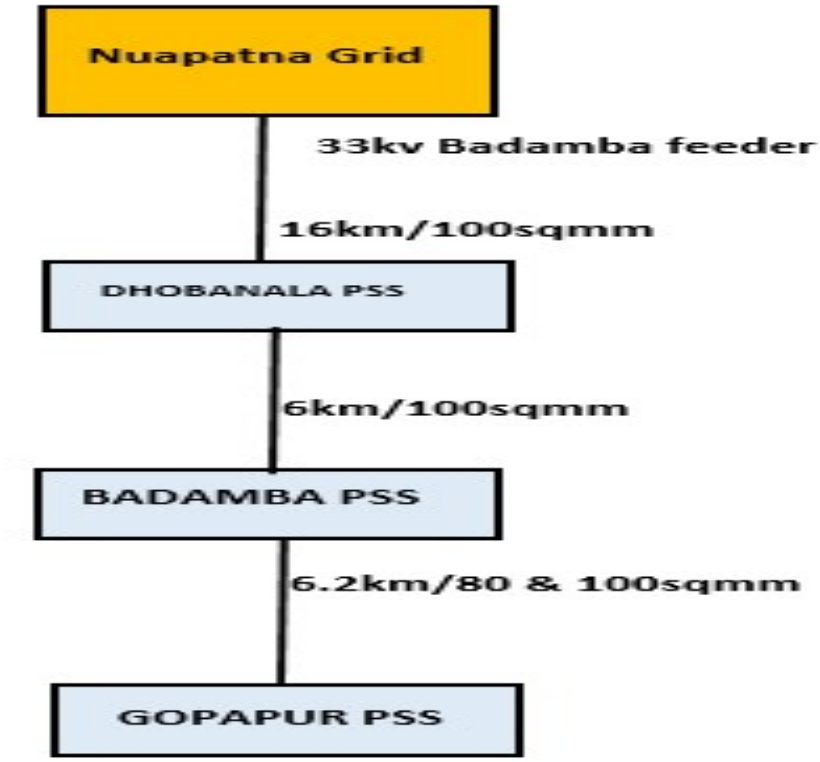
Existing 33kv Badamba feeder emanating from Nuapatna Grid currently feeding Dhobanala PSS, Badamba PSS and Gopapur PSS. The feeder total length 28.2 Ckt Km. The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes

in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	28.2
Nuapatna	Badamba	Badamba	28.6
Nuapatna	Badamba	Dhobanala	29.5

In existing feeder, the section between Nuapatna Grid and Dhobanala PSS is having 100 sqmm conductor for length of 16 Ckt Km. As the conductor is undersized, there is low voltage condition persisting on tail end of feeder. Gopapur, Badamba and Dhobanala are receiving lower voltage (<9% voltage drop).

Figure 33: Existing SLD : Nuapatna Grid to Dhobanala PSS



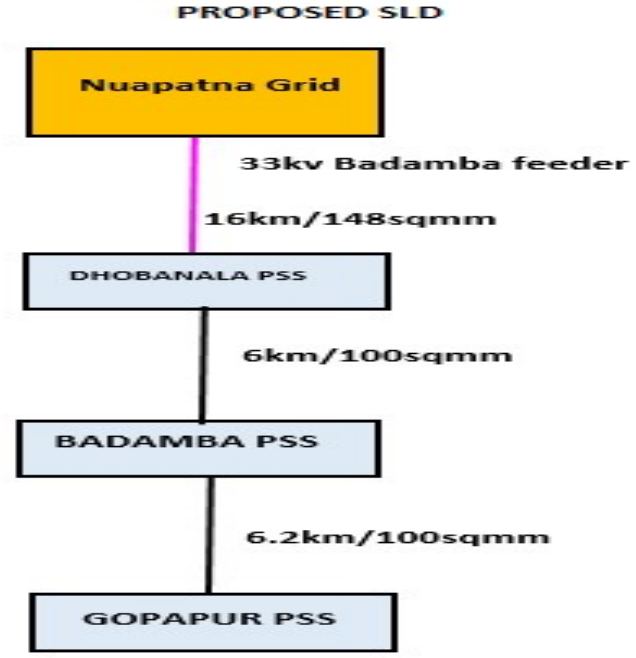
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Dhobanala PSS, it is proposed to augment existing conductor size from 100sqmm to 148sqmm between Nuapatna Grid to Dhobanala PSS which will improve the voltage at Dhobanala PSS as follows:

.

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	29.4
Nuapatna	Badamba	Badamba	28.6
Nuapatna	Badamba	Dhobanala	30.2

Figure 34: Proposed SLD : Nuapatna Grid to Dhobanala PSS



- **Benefits**

1) Low voltage problem will be solved at Gopapur PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve

3.8.4 Dhobanala PSS to Badamba PSS

- **Existing Scenario:-**

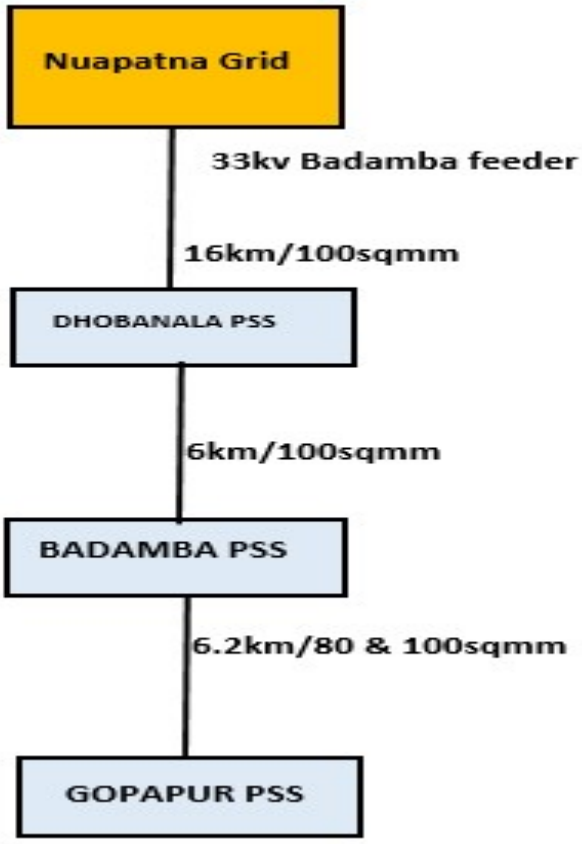
Existing 33kv Badamba feeder emanating from Nuapatna Grid currently feeding Dhobanala PSS, Badamba PSS and Gopapur PSS. The feeder total length 28.2 Ckt Km.

The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	28.2
Nuapatna	Badamba	Badamba	28.6
Nuapatna	Badamba	Dhobanala	29.5

In existing feeder, the section between Dhobanala PSS and Badamba PSS is having 100 sqmm conductor for length of 6 Ckt Km. As the conductor is undersized, there is low voltage condition persisting on tail end of feeder. Gopapur, Badamba and Dhobanala are receiving lower voltage (<9% voltage drop).

Figure 35: Existing SLD : Dhobanala PSS to Badamba PSS



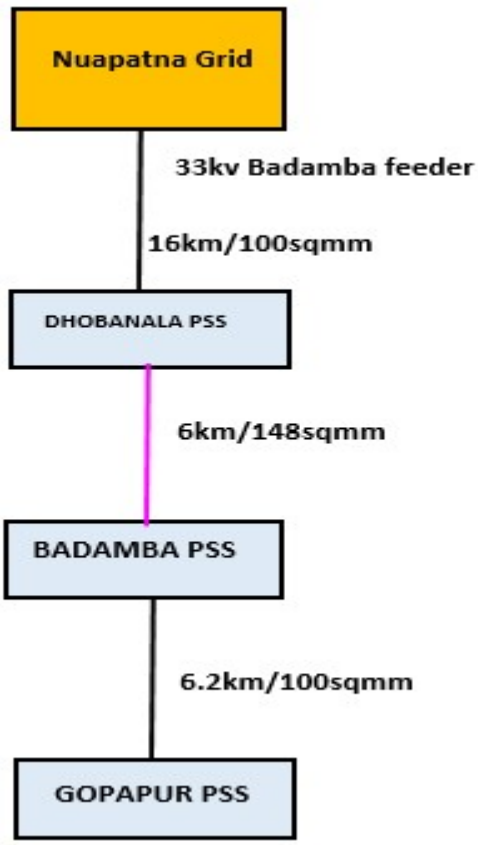
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Badamba PSS, it is proposed to augment existing conductor size from 100sqmm to 148sqmm between Nuapatna Grid to Dhobanala PSS which will improve the voltage at Dhobanala PSS. At Badamba PSS, it is proposed to change the Power TRF HT Side Tap to maintain 11KV Bus voltage at PSS as follows:

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Nuapatna	Badamba	Gopapur	28.2
Nuapatna	Badamba	Badamba	29.4
Nuapatna	Badamba	Dhobanala	29.5

- **Proposed SLD**

Figure 36: Proposed SLD : Dhobanala PSS to Badamba PSS



- **Benefits**

1) Low voltage problem will be solved at Gopapur PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve

3.8.5 Panchupada/Khajuriakta Grid to Hindol Road PSS

- **Existing Scenario:-**

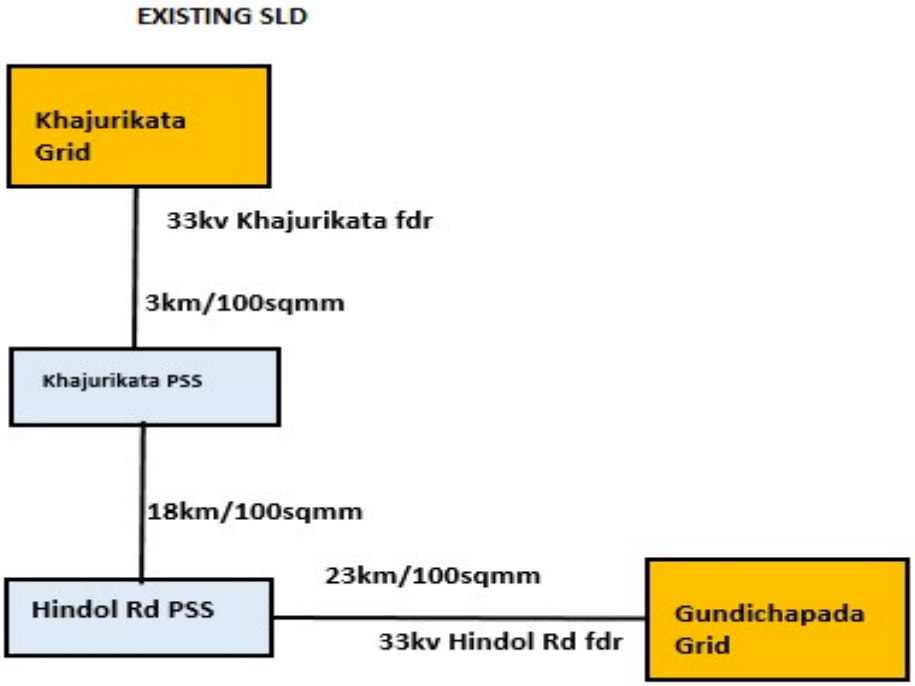
Existing 33kv Khajurikata feeder emanating from Khajurikata Grid currently feeding Khajurikata PSS. Existing 33kv Hindol Road Feeder emanating from Gundichapada Grid currently feeding Hindol Road PSS. There is n-1 connectivity between Khajurikata feeder and Hindol Road feeder. The feeder total length 44 Ckt Km. The peak load of Khajurikata feeder is 3MVA and Hindol road feeder is 7.1MVA.

The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Khajurikata	Khajurikata	Khajurikata	31.8
Gundichapada	Hindol Road	Hindol Road	28.3

In existing feeder, the section between Khajurikata Grid and Hindol Road PSS is having 100 sqmm conductor for length of 21 Ckt Km and Section between Hindol Rd PSS and Gundichapada Grid is on 100 sqmm for length 23km. As the conductor is undersized, there is low voltage condition persisting on Hindol Road PSS which is receiving lower voltage (<9% voltage drop).

Figure 37: Existing SLD -Panchupada/Khajuriakta Grid to Hindol Road PSS

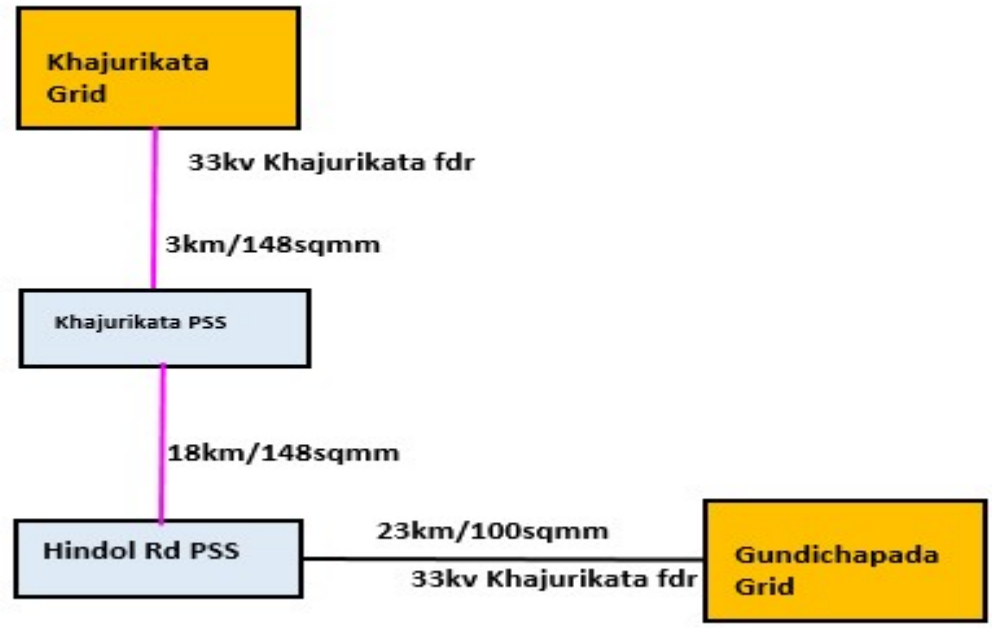


- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Hindol Road PSS, it is proposed to augment existing conductor size from 100sqmm to 148sqmm between Khajurikata Grid to Hindol Road PSS and Hindol Road PSS to feed from Khajurikata Grid, which will improve the voltage at Hindol Road PSS.

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Khajurikata	Khajurikata	Khajurikata	31.8
Khajurikata	Khajurikata	Hindol Road	30.4

Figure 38: Proposed SLD -Panchupada/Khajuriakta Grid to Hindol Road PSS



- **Benefits**

1) Low voltage problem will be solved at Hindol Road PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve.

3.8.6 (a) Augmentation of Conductor from Khandapada PSS to Dhalabandha (b) Augmentation of Conductor from Dhalabandha T-OFF to Fategarh PSS (c) Augmentation of Conductor from Fategarh T-OFF to Bijipur PSS (d) Augmentation of Conductor From Khandapada PSS to Kantilo PSS

- **Existing Scenario:-**

Existing 33kv Khandapada feeder emanating from Rajpatna Grid currently feeding 8 no. PSS namely Balugaon PSS, Khandapada PSS, Dhalabandha PSS, Bijipur PSS, Fategarh PSS, Kantilo

PSS, Gania PSS and Chamundia PSS. The feeder total length 102 Ckt Km. The loading of feeder is 13.6MVA.

The feeder is having mixed of different conductor Size .Since the feeder is lengthy & having lower conductor sizes in the circuit, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS from the feeder is given below

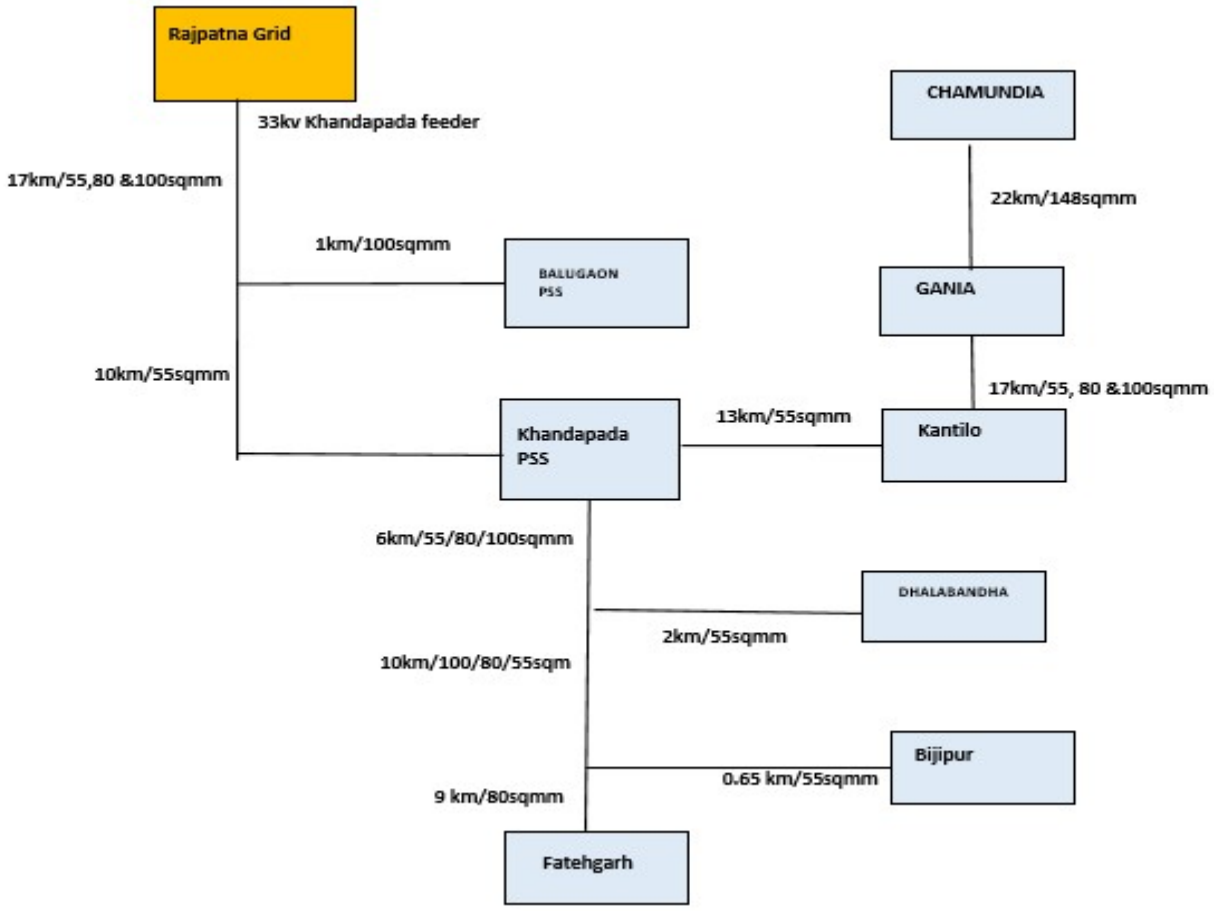
Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rajpatna	Khandapada	Balugaon	30.27
Rajpatna	Khandapada	Khandapada	28.47
Rajpatna	Khandapada	Dhalabandha	28.06
Rajpatna	Khandapada	Bijipur	27.37
Rajpatna	Khandapada	Fategarh	27.05
Rajpatna	Khandapada	Kantilo	27.2
Rajpatna	Khandapada	Gania	25.77
Rajpatna	Khandapada	Chamundia	25.71

In existing feeder,

a. the section between Khandapada PSS and Dhalabandha is having 55/80/100 sqmm conductor for length of 8 Ckt Km.
b. the section between Dhalabandha T-off and Fategarh PSS is having 55/80/100 sqmm conductor for length of 19KM
c. the section between Fategarh T-off to Bijipur is having 55sqmm for length of 0.65KM.
d. the section between Khandapada PSS to Kantilo PSS having 55sqmm for length of 13km.

As the conductor is undersized, there is low voltage condition persisting on Dhalabandha, Bijipur, Fartegarh, Kantilo, Gania and Chamundia PSS which is receiving lower voltage (<9% voltage drop).

Figure 39: Existing SLD of the four schemes under consideration



- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Dhalabandha, Bijipur, Fartegarh, Kantilo, Gania and Chamundia PSS, it is proposed to augment existing conductor size as below:-

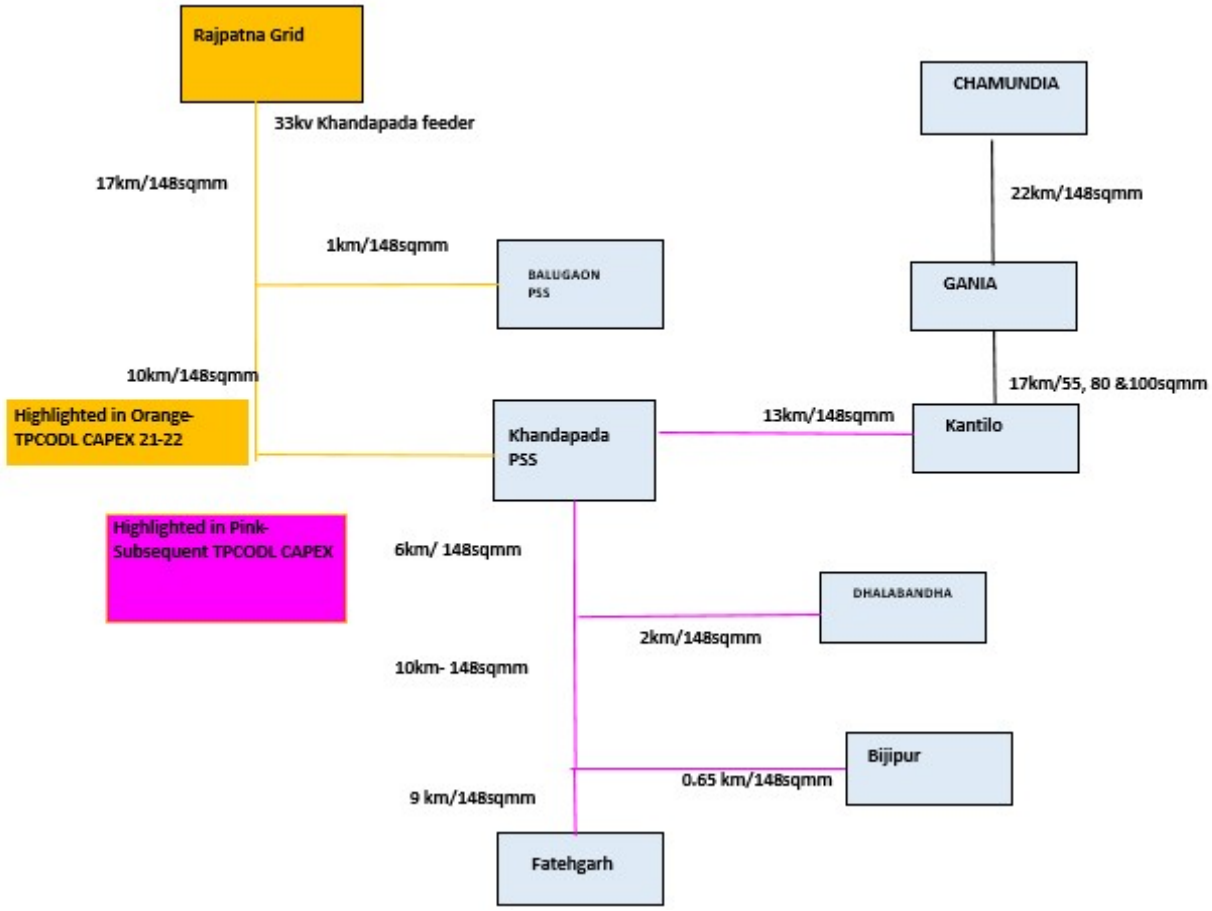
a) From 55/80/100 sqmm to 148sqmm between Khandapada PSS to Dhalabandha PSS
b) From 55/80/100 sqmm to 148sqmm between Dhalabandha T-OFF to Fategarh PSS
c) From 55 sqmm to 148sqmm between Fategarh T-off to Bijipur PSS and
d) From 55 sqmm to 148sqmm between Khandapada PSS to Kantilo PSS

For Section between Khandapada Grid to Khandapada PSS which includes Khandapada PSS and Balugaon PSS with a total length of 28KM on existing 55/80/100 sqmm, the Conductor augmentation is already being executed in TPCODL CAPEX 21-22 which will improve voltage at Khandapada PSS and Balugaon PSS

The above augmentation will improve the voltage at Khandapada PSS, Balugaon PSS, Dhalabandha PSS, Bijipur PSS, Fategarh PSS, Kantilo PSS, Gania PSS and Chamundia PSS

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rajpatna	Khandapada	Balugaon	30.27
Rajpatna	Khandapada	Khandapada	30.7
Rajpatna	Khandapada	Dhalabandha	31.1
Rajpatna	Khandapada	Bijipur	30.7
Rajpatna	Khandapada	Fategarh	30.6
Rajpatna	Khandapada	Kantilo	30.4
Rajpatna	Khandapada	Gania	30.2
Rajpatna	Khandapada	Chamundia	30

Figure 40: Proposed SLD of the four schemes under consideration



- **Benefits**

1. Low voltage problem will be solved at Khandapada PSS, Balugaon PSS, Dhalabandha PSS, Bijipur PSS, Fategarh PSS, Kantilo PSS, Gania PSS and Chamundia PSS.
2. Technical loss will be reduced.
3. Feeder reliability will improve.

3.9 Part C : Construction of 33kv New Lines from existing/ Proposed Grid

Construction of New Lines

The schemes under Part C are summarised as follows:

Table 43: Construction of 33 KV New lines from existing/proposed Grid Substation.

Sl no	Circle	From	TO	Length (KM)	Conductor size	Structure name	Costing (in Cr)
1	BBSR-2	Shamuka Grid 4 pole	Brahmagiri	10	148	BRAHMAGIRI	3.4
2	BBSR-2					KHAJURIA	
3	BBSR-2					SUNAMUHIN	
4	BBSR-2					JAMALGADA	
5	BBSR-2					Panaspada	
6	BBSR-2	Baghmari PSS	Proposed 4P at Baghmari	0.2	148	GEDIAPALLI	0.1
7	BBSR-2					Baghmari	
8	BBSR-2					KALAPATHAR	
9	BBSR-2					BEGUNIA	
10	BBSR-2					PARICHHALA	
11	Paradeep	Existing Jagatsingpur Grid	Sova	30	232	BALIKUDA	11.4
12	Paradeep					SOVA	
13	Paradeep					DUVALO	
14	Dhenkenal	Rengali GRID	Kaniha	30	232	Kaniha	8.1
15						Hanumanpur	
16	Angul	Rengali GSS to.	33/11KV Khamar PSS	25	232	Khamar Kunjam Parbil Baruan	9
				95.2			32

3.9.1 Construction of New line from Shamuka Grid 4pole to Brahmagiri PSS

- **Existing Scenario:-**

Existing 33kv Alarnath feeder emanating from Shamuka Grid currently feeding Brahmagiri PSS, Sunamuhi PSS, Khajuria PSS, Jamalgada PSS and upcoming Panaspada PSS. The feeder total length 58.5Ckt Km. The peak load of feeder is 9.7MVA.

Existing 33kv Charinala feeder emanating from Shamuka Grid is feeding Basudeipur PSS. The total feeder length is 8.5KM. The peak load of feeder is 1.7MVA.

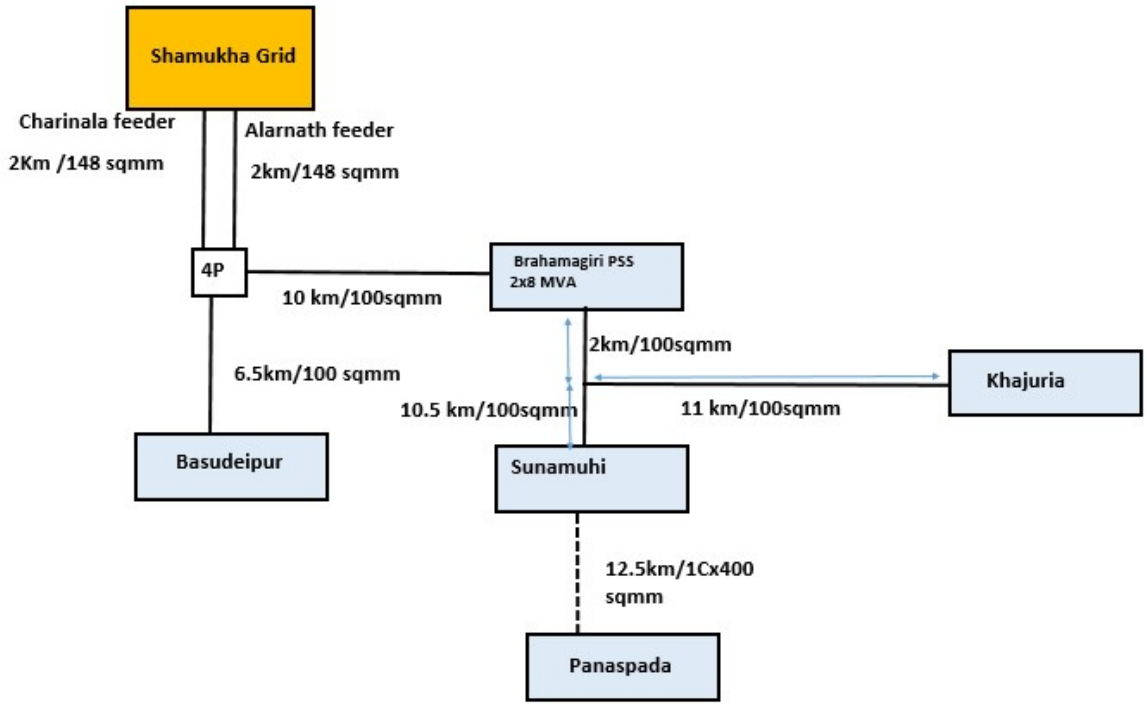
The 33kv Alarnath feeder is having mixed of different conductor Size .Since the feeder is lengthy, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Samuka	Alarnath	Brahmagiri	30
Samuka	Alarnath	Sunamuhi	29.1
Samuka	Alarnath	Khajuria	29.3
Samuka	Alarnath	Panaspada	29.0
Samuka	Charinala	Basudeipur	32.1

As single feeder feeding to 4 no PSS, there is low voltage condition persisting on tail end of feeder. Sunamuhi, Khajuria and Panaspada are receiving lower voltage (<9% voltage drop).

- **Existing SLD**

Figure 41: Existing SLD from Shamukha Grid



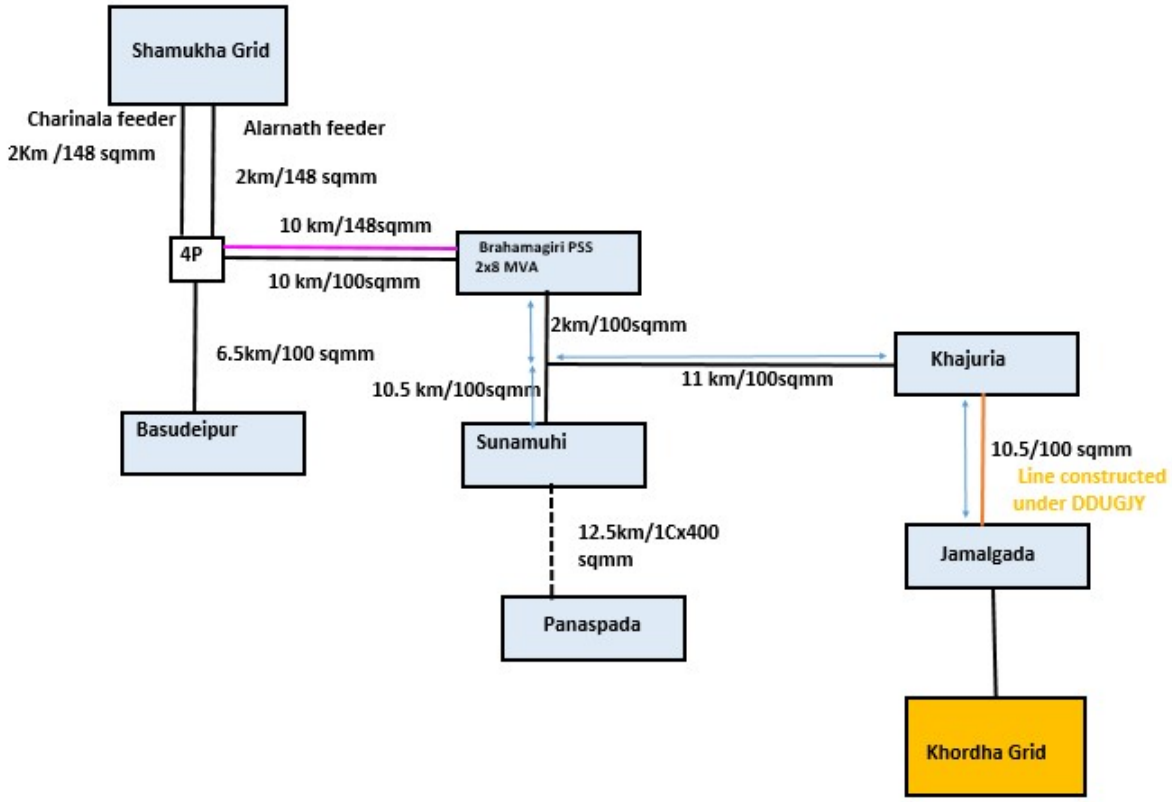
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Sunamuhi, Jamalgada, Khajuria and Panaspada, it is proposed to construct a new line from Shamuka 4pole to Brahmagiri PSS of lenghth 10 KM on 148sqmm. It is proposed to run Basudeipur and Brahmagiri PSS on Charinala feeder and Sunamuhi, Panaspada, Khajuria and Jamalgada on Alarnath feeder.

At Khajuria PSS, Panaspada PSS, Jamalgada PSS, it is proposed to change the Power TRF HT Side Tap to maintain 11KV Bus voltage at PSS.

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Samuka	Alarnath	Sunamuhi	29.7
Samuka	Alarnath	Khajuria	29.8
Samuka	Alarnath	Panaspada	29.5
Samuka	Charinala	Basudeipur	31.9
Samuka	Alarnath	Jamalgada	29.6
Samuka	Charinala	Brahmagiri	30.9

Figure 42: Proposed SLD from Shamukha Grid



- **Benefits**

1) Low voltage problem will be solved at Sunamuhi, Brahmagiri PSS, Panaspada PSS, Khajuria PSS and Jamalgada PSS
2) Technical loss will be reduced.
3) Feeder reliability will improve

3.9.2 Construction of New line and 4pole from Baghmari PSS to proposed 4pole near Baghmari

- **Existing Scenario:-**

Existing 33kv Charichaka feeder emanating from Banki Grid currently feeding Baghmari, Gediapally and Kalapathar PSS. The feeder lenghth is 33km. The peak load of feeder is 4.9MVA.

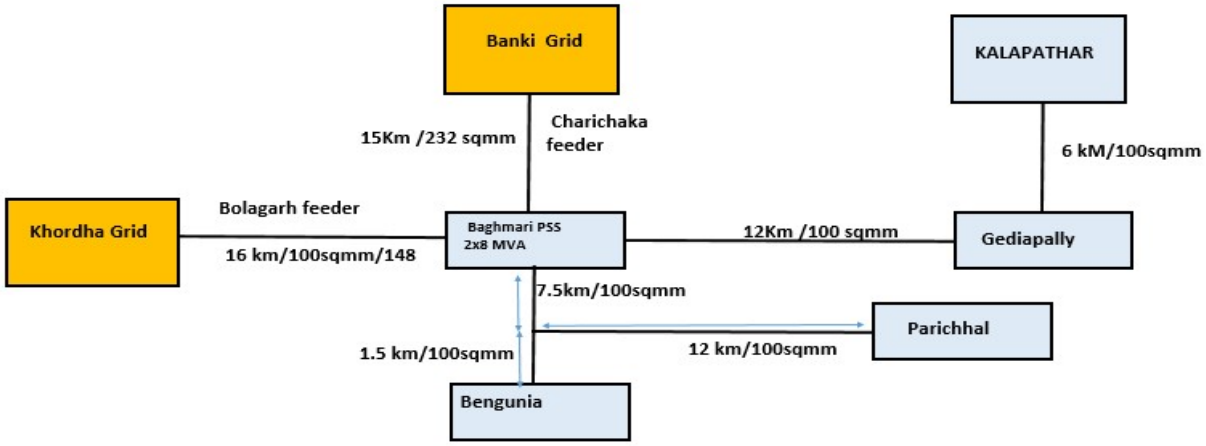
Existing 33kv Bolagarh feeder emanating from Khordha Grid is feeding Begunia and Parichhal PSS. The total feeder length is 37KM. The peak load of feeder is 9.37MVA.

The 33kv Charchika and Bolagarh feeder is having mixed of different conductor Size .Since the feeder is lengthy, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Banki	Charchika	Baghmari	29.9
Banki	Charchika	Gediapally	29.5
Banki	Charchika	Kalapathar	29.4
Khordha	Bolagarh	Begunia	29.6
Khordha	Bolagarh	Parichhal	29.2

There is low voltage condition persisting on Baghmari, Gediapally, Kalapathar, Begunia and Parichhal are receiving lower voltage (<9% voltage drop).

Figure 43: Existing SLD from Baghimari Substation



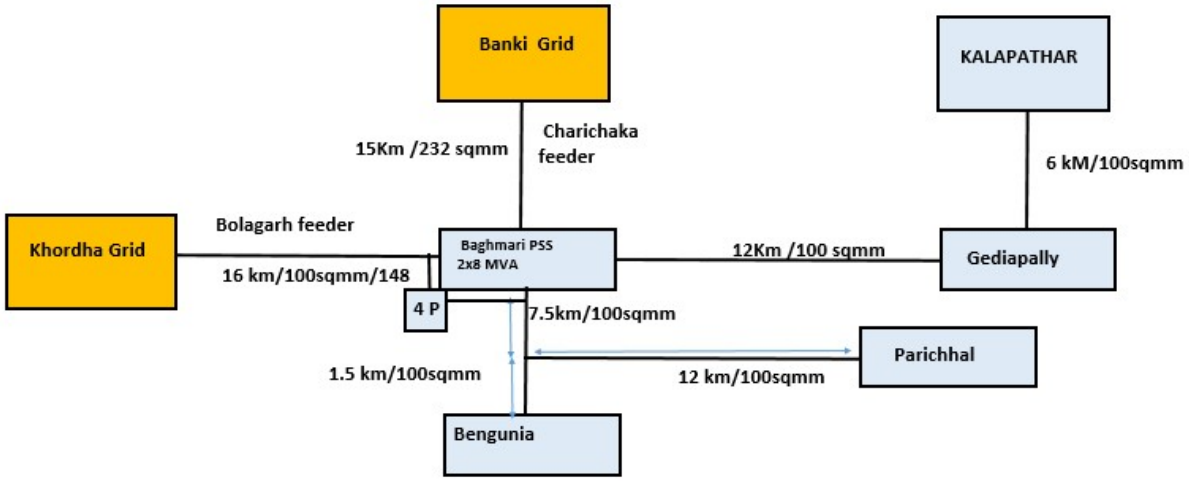
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Baghmari, Gediapally, Kalapathar, Begunia and, it is proposed to construct a new line of 0.1KM and 4pole at Baghmari PSS on 148sqmm.

It is proposed to run Baghmari, Begunia and Parichal PSS on Bolagarh feeder and Gediapally and Kalapathar on Charchika Feeder by changing operation at proposed 4 pole. The Voltages improve to the following:

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Khordha	Bolagarh	Baghmari	31.6
Banki	Charchika	Gediapally	31
Banki	Charchika	Kalapathar	31
Khordha	Bolagarh	Begunia	31.3
Khordha	Bolagarh	Parichhal	30.8

Figure 44: Proposed SLD from Baghimari Substation



- **Benefits**
  1. Low voltage problem will be solved at Begunia, Parichal, Gediapally , Kalapathar PSS
  2. Technical loss will be reduced.
  3. Feeder reliability will improve

3.9.3 Construction of 33kv New line from Jagatsinghpur Grid to Sova PSS

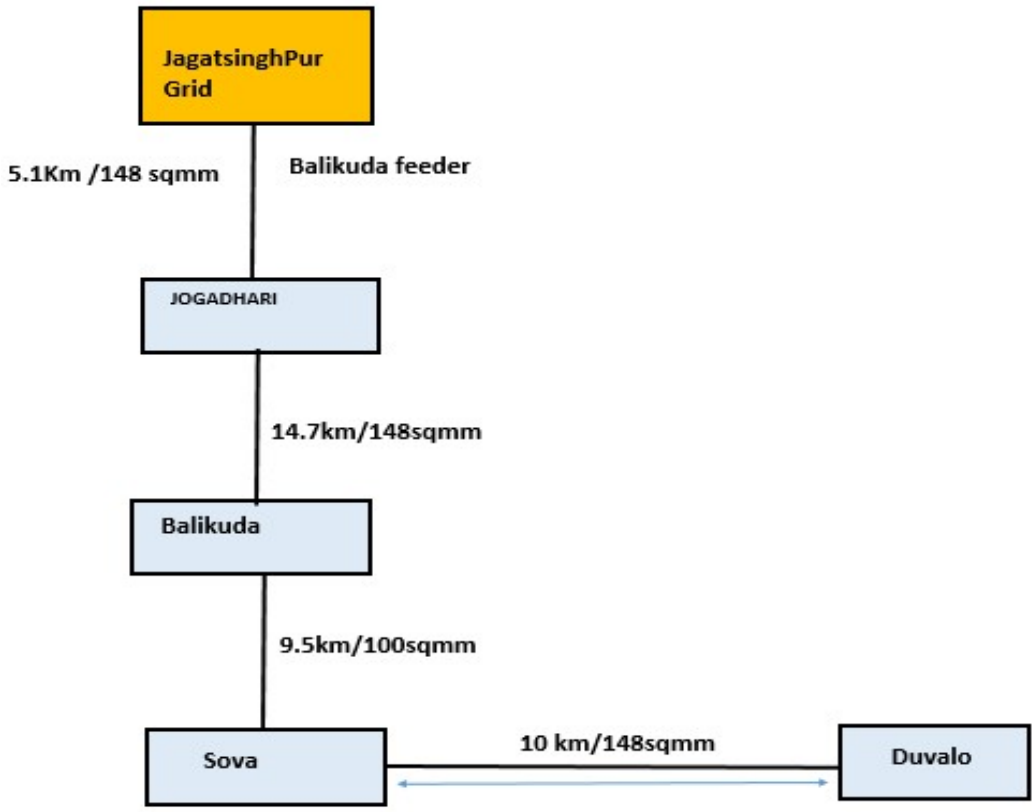
- **Existing Scenario:-**

Existing 33kv Balikuda feeder emanating from Jagatsinghpur Grid currently feeding Jogadhari, Balikuda, Sova, Duvalo PSS. The feeder lenghth is 39.3km. The peak load of feeder is 11.4MVA. The 33kv Balikuda feeder is having mixed of different conductor Size .Since the feeder is lengthy, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Jagatsinghpur	Balikuda	Jogadhari	31.4
Jagatsinghpur	Balikuda	Balikuda	28.5
Jagatsinghpur	Balikuda	Sova	27.7
Jagatsinghpur	Balikuda	Duvalo	27.7

There is low voltage condition persisting on Balikuda, Sova and Duvalo PSS , which are receiving lower voltage (<9% voltage drop).

Figure 45: Existing SLD from Jagatsinghpur Grid to Sova PSS



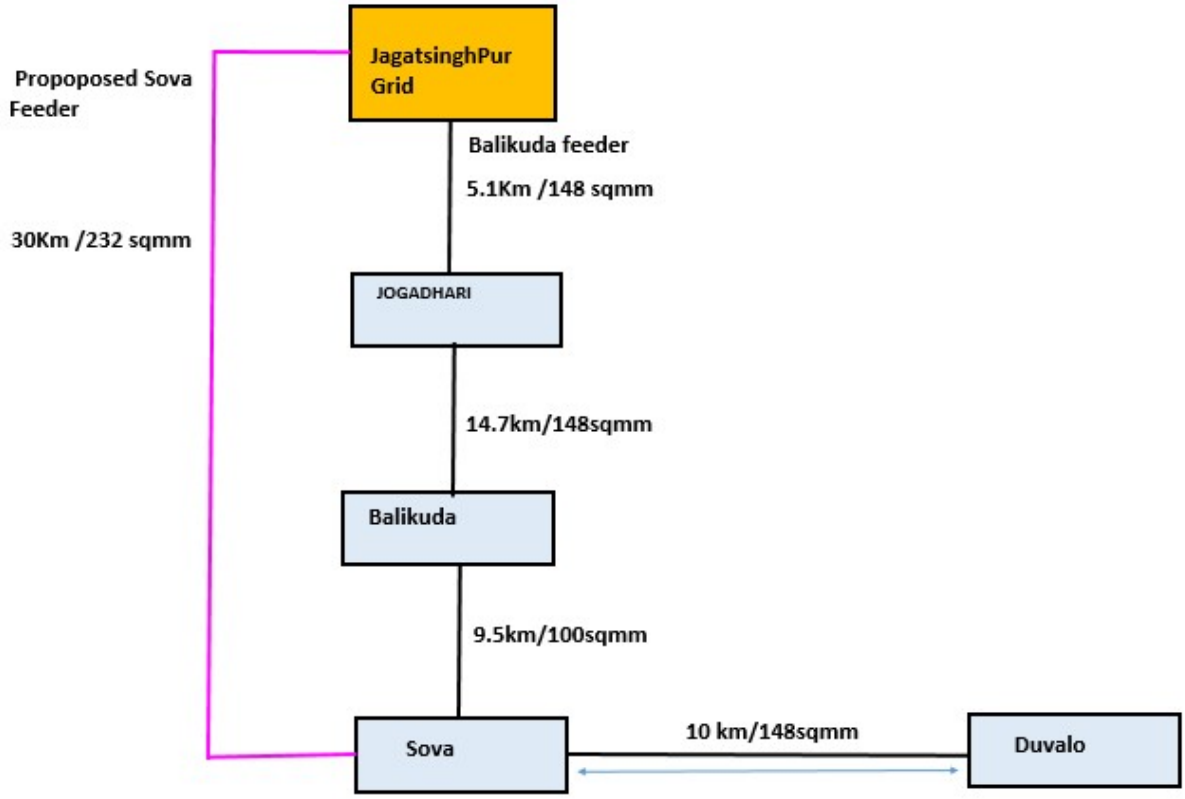
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Balikuda, Sova and Duvalo PSS , it is proposed to construct a new line of 30KM on 232sqmm AAAC from Jagatsinghpur Grid to Sova PSS alongwith construction of 33kv Bay with Bus section at Sova PSS.

It is proposed to run Sova PSS and Duvalo PSS on proposed Sova feeder from Jagatsinghpur Grid. Jogadhari and Balikuda will run on existing 33kv Balikuda feeder. The Voltagres would improve as follows:

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Jagatsinghpur	Balikuda	Jogadhari	31.7
Jagatsinghpur	Balikuda	Balikuda	30.3
Jagatsinghpur	Proposed Sova	Sova	30.5
Jagatsinghpur	Proposed Sova	Duvalo	30.5

Figure 46: Proposed SLD from Jagatsinghpur Grid to Sova PSS



- **Benefits**

1) Low voltage problem will be solved at Balikuda, Sova and Duvalo PSS.
2) Technical loss will be reduced.
3) Feeder reliability will improve.

3.9.4 Construction of 33kv New line from Rengali Grid to Kaniha PSS

- **Existing Scenario:-**

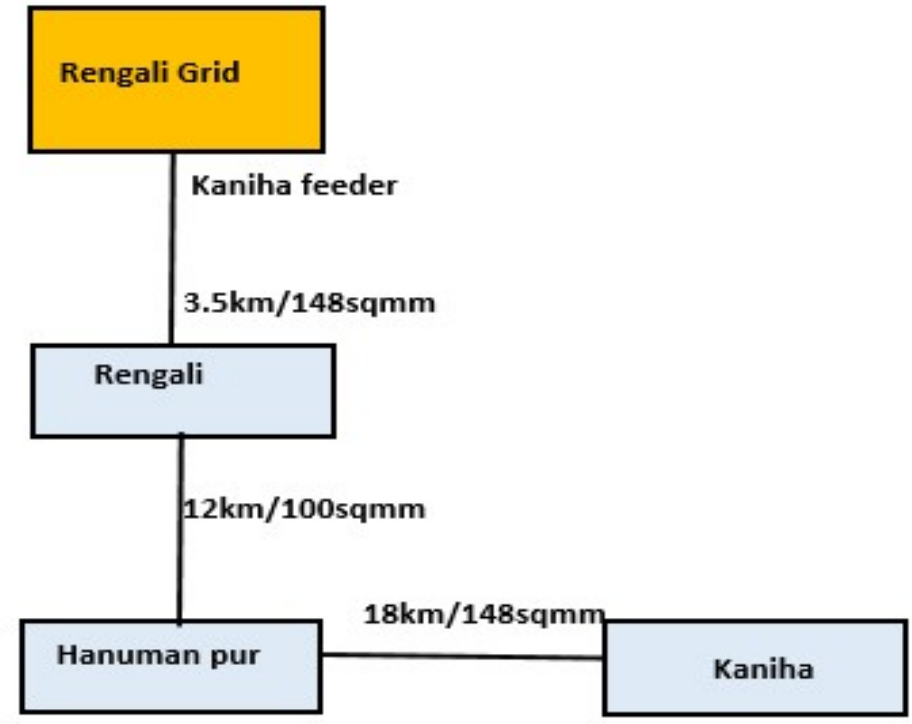
Existing 33kv Kaniha feeder emanating from Rengali Grid currently feeding Rengali PSS, Hanumanpur PSS and Kaniha PSS. The feeder lenghth is 33.5km. The peak load of feeder is 8.5MVA.

The 33kv Kaniha feeder is having mixed of different conductor Size. Since the feeder is lengthy, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rengali	Kaniha	Rengali	31.8
Rengali	Kaniha	Hanumanpur	29.5
Rengali	Kaniha	Kaniha	28.2

There is low voltage condition persisting on Hanumanpur and Kaniha PSS , which are receiving lower voltage (<9% voltage drop).

Figure 47: Existing SLD from Rengali Grid to Kaniha PSS



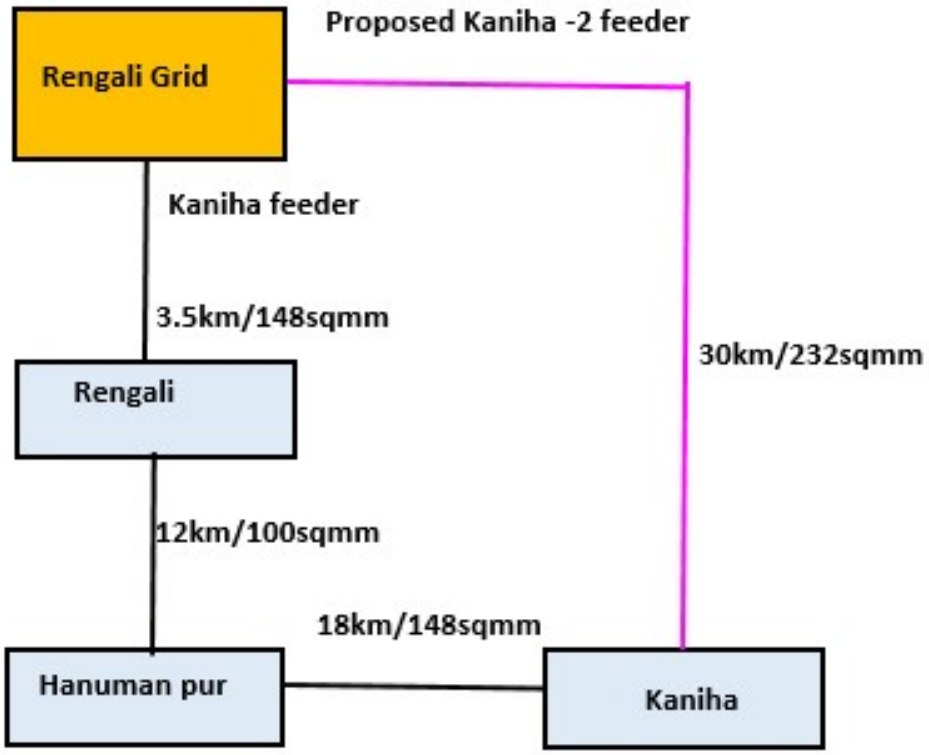
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Hanumanpur PSS and Kaniha PSS, it is proposed to construct a new line of 30KM on 232 sqmm AAAC from Rengali Grid to Kaniha PSS.
It is proposed to run Kaniha PSS on proposed Kaniha-2 feeder from Rengali Grid. Rengali and Hanumanpur PSS will run on existing 33kv Kaniha feeder.

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rengali	Kaniha	Rengali	32

Rengali	Kaniha	Hanumanpur	31.8
Rengali	Kaniha-2	Kaniha	30.1

Figure 48: Proposed SLD from Rengali Grid to Kaniha PSS



Benefits

1) Low voltage problem will be solved at Hanumanpur and Kaniha PSS.
2) Technical loss will be reduced.
3) Feeder reliability will improve.

3.9.5 Construction of 33kv New line from Rengali Grid to Khamar PSS

- **Existing Scenario:-**

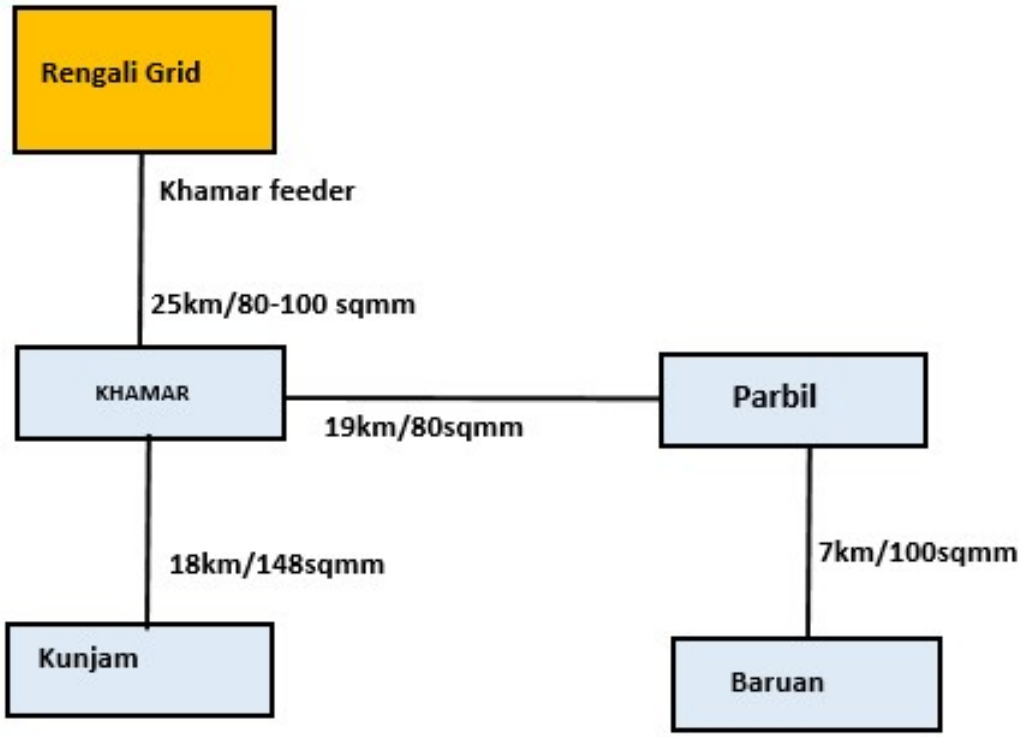
Existing 33kv Khamar feeder emanating from Rengali Grid currently feeding Khamar PSS, Parbil PSS, Baruan PSS and Kunjam PSS. The total feeder length is 69km. The peak load of feeder is 7MVA.

The 33kv Khamar feeder is having mixed of different conductor Size. Since the feeder is lengthy, low voltage is observed at some of PSS end. The 33KV Voltage at each PSS feed from the feeder is given below

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rengali	Khamar	Khamar	29.1
Rengali	Khamar	Kunjam	28.4
Rengali	Khamar	Parbil	28.6
Rengali	Khamar	Baruan	28.5

There is low voltage condition persisting on Khamar PSS, Kunjam PSS, Parbil PSS and Baruan PSS , which are receiving lower voltage (<9% voltage drop).

Figure 49: Existing SLD from Rengali Grid to Khamar PSS



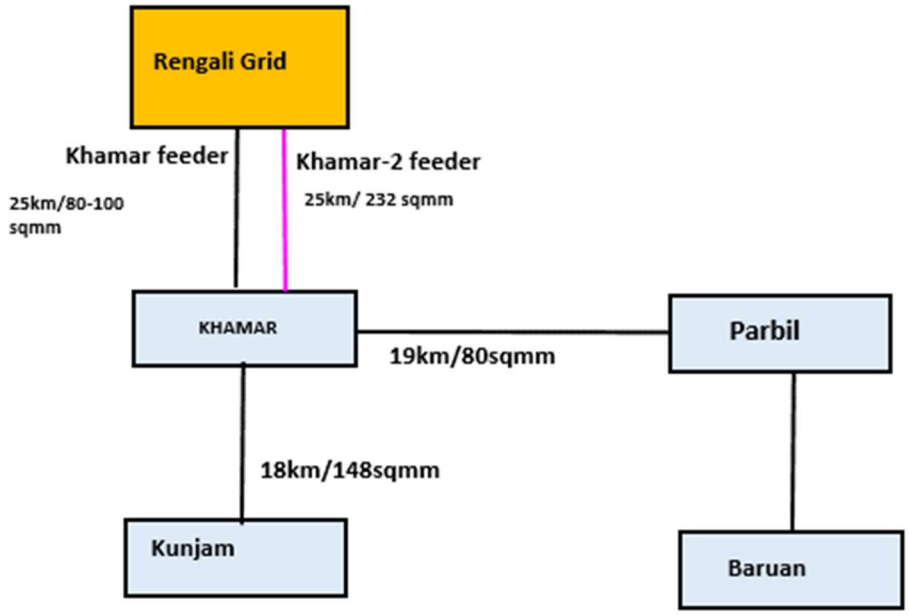
- **Proposal to mitigate low voltage -**

To mitigate the low voltage on Khamar PSS, Kunjam PSS, Parbil PSS and Baruan PSS, it is proposed to construct a new line of 25KM on 232 sqmm AAAC from Rengali Grid to Khamar PSS alongwith construction of New Bay with Bus section arrangement.

It is proposed to run Khamar and Kunjam PSS on proposed Khamar-2 feeder from Rengali Grid. Parbil PSS and Baruan PSS will run on existing 33kv Khamar feeder. The Voltages would improve as follows:

Grid Name	33 KV Feeder Name	Structure Name	33 KV Bus Voltage in KV
Rengali	Proposed Khamar-2	Khamar	30.6
Rengali	Proposed Khamar-2	Kunjam	30.1
Rengali	Existing Khamar	Parbil	31.2
Rengali	Existing Khamar	Baruan	31.1

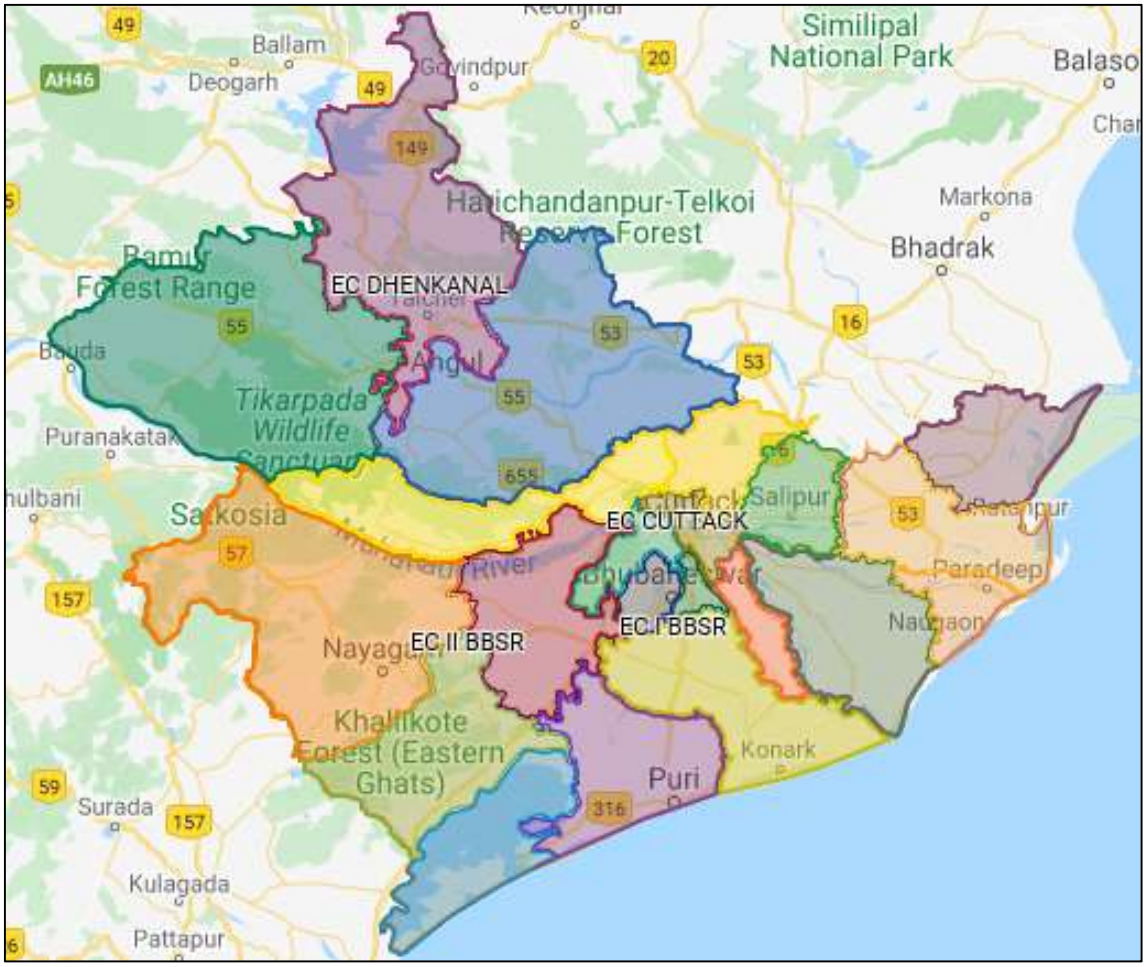
Figure 50: Proposed SLD from Rengali Grid to Khamar PSS



Benefits

1. Low voltage problem will be solved at Khamar, Kunjam, Parbil and Baruan PSS.
2. Technical loss will be reduced.
3. Feeder reliability will improve.

4 Annexure 3 – Schemes proposed to be completed within a year (“Yearly Schemes)



Yearly Schemes- Which would be commenced and completed in the year

(BOQs given Annexure 8- BOQ for Yearly Schemes)

4.1 Yearly Schemes -Safety and Security

The description of schemes under Sr No 1- 9 of **Table *1* Expenditure Proposal Summary for FY 2022-23 (Hard Cost**) is as given in this chapter Accordingly, the proposed budget for Safety & Statutory under CAPEX FY 22-23 is Rs 20.51 Crs. The details of the same are as given in the table below

Table 44 : Capital Expenditure Safety and Security

Main Budget head	Sr No	Activity planned	Proposed Budget (Rs Cr)	Proposed in FY 2022-23
Safety & Statutory	1	Load Forecasting Software as a part of compliance to DSM guidelines	0.15	0.15
	2	Procurement of Safety gadgets and equipment	5.05	5.05
	3	Construction of training institute for TPCODL	1.5	1.5
	4	Unsafe to Safe Locations - Interposing Poles	5	5
	5	Test Lab development at various MMG Divisions	0.49	0.49
	6	Boundary Wall/ FRP Fencing/ Construction of Plinth	3.5	3.5
	7	Stores - Water hydrant system & Intrusion Detection System	2	2
	8	Testing instrument for STS	3.2	3.2
	9	**Total**	**20.89**	**20.89**

The description of the various schemes are as under

4.1.1 Load Forecasting Software

- **Existing System in Place**

Presently day ahead load forecasting is done using an Excel based approach with some historical data. This is submitted on the earlier day to SLDC for incorporation as the Discoms day ahead schedule. Presently Deviation Settlement Mechanism (DSM) is not applicable in Odisha Discoms and hence there is no penalty levied for deviation of the actual drawl with respect to the schedule. The accuracy with excel based day ahead forecasting has its own limitations.

- **Need of Project**

The draft regulations for Deviation Settlement Mechanism have been published by Hon'ble Odisha Electricity Regulatory Commission for comments and very soon the DSM Regulations would be applicable in the state of Odisha. In order to improve the accuracy of Load Forecasting, it is required that a System Based approach be adopted. In line with this, a pilot project for Load Forecasting based on AI is being carried out to see the efficacy of system

based LF. As the improvement in accuracy of LF, as a Discoms TPCODL would be adhering to is scheduled drawl and help in maintaining Grid Stability and avoiding any DSM charges.
As the current trend of doing the forecasting manually involves error and also does not take into account the climatic parameters, it is proposed to get on board a partner for developing a system based forecasting tool for accurate load forecasting.

- **Scope of Proposal**

The scope of this proposal includes investment for a forecasting tool. In order to increase the Load Forecasting accuracy & be within the deviation limits of the Discoms, this software is being proposed.

- **Cost Estimate with Execution Timelines**

The cost estimate of the project is **Rs.0.15 Cr** and the execution would be phase wise as per the requirement of Short term and Long term forecasting

- **Proposed System after Implementation**

With implementation of this tool, there would be clarity on day ahead forecasting taking into account the seasonal variation. Also as per requirement of Hon'ble OERC, the long term forecasting will get prepared accordingly taking into account seasonal, consumer type and geographical variations.

- **Cost Benefit Analysis**

After implementation of the above stated infrastructure, there would an accurate load forecasting and relief from unwanted penalties/charges under DSM Regulations

- **Conclusion**

Considering the above stated analysis and for the benefit of the system complying to the statutory guidelines, proposed investment for a new load forecasting tool is justified and is being put up for approval.

4.1.2 Procurement of Safety Gadgets and 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 5.21 Crs
Benefit	The implementation of TSHMS will lead to safety of all Stakeholders – from Employees to consumers. 1. Use of safety gadgets will decrease the chances of accidents and thereby ensure a safe work environment for employees and will also reduce the threats on external stakeholders. 2. For inculcation of safe working culture among our employees and to educate them about the necessity of safety in our work life, TPCODL is proposing for its' own permanent training centre.

Expenses for procurement of Safety Gadgets:

Safety gadgets is required to be provided to the workforce for the safe execution of work. Equipment such as ladders, shorting links, barricade tape, first aid box, tool kit etc. are some of the essential necessities needed to be provided. Most of the sections are not equipped with discharge rods or neon testers. Thus during maintenance/ breakdown activities, there is a high chance of electrocution due to improper grounding leading to leakage current. With neon tester it will be possible to detect any leakage current in lines and in such cases, discharge rod can be used to ground the leakage current before starting the work, so as to minimize chances of accidents. Non-availability of abundant LOTO locks often lead to miscommunication between two field groups working on the same line and lead to several cases of electrocution and often death. Use of LOTO Locks at isolation points will help to prevent line charging when multiple groups are working on the same line.

Expenses for procurement of Safety Equipment:

a) **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.

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

c) **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. Fiber glass ladders of 9 meters

& 12 meters will be provided for working at height conditions (greater than 6 feet, i.e. 1.8 mtrs), thus reducing the chances of fall from height accidents.

d) 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. In the first phase, it was proposed to procure 5 nos of porta cabins & these will be installed at 5 different practice yard of each of the circles. Now we are proposing of 5 more porta cabins in Phase II. Gradually we plan to have 1 porta cabin per division, i.e. total 20 for pan TPCODL.

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

f) Public Safety Gadgets: Safety of employees and consumers are the top priorities for TPCODL. Prior to start of any activities, it is important to make the locals aware that about the ongoing job. For this purpose, it is proposed to procure public address system, LED display screen for public safety awareness and barricade tape.

Table 45 : Capital Expenditure on Safety Gadgets and Equipment

Sl No	Description of Item	Unit	Quantity	Rate (Rs)	Total Amount (Rs)
1	FRP Ladder 3 folded type (9mtr)	No	300	16340	4902000
2	FRP Ladder folded type (12mtr)	No	300	12378	3713400
3	Portable Discharge Rod (3 folded 15feet)	No	1500	10000	15000000
4	HV Neon Tester	No	500	20355	10177500
5	Public address system	No	100	5355	535500
6	LOTO locks	No	5000	375	1875000
7	Porta Cabin for training	No	15	425000	6375000
8	Lineman Tool Kit with canvas bag	Set	700	7000	4900000
9	LED display screen for public safety awareness	No	10	300000	3000000
Total Budget Required					**50478400**

4.1.3 Construction of Training Institute for TPCODL.

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. For this purpose, it is proposed to construct one permanent training centre apart from the 5 porta cabins. This amounts to **Rs 1.5 Crores** for one training centre.

4.1.4 Unsafe to Safe Location

Scheme Proposed	It is proposed to erect intermediate poles to ensure safety and reliable power supply to end consumers.
Capex Amount	**Rs 5.0 Cr**
Benefit to customer	To ensure safety and reliable power supply to end consumers

- **Existing System**

TPCODL spanning over a geographical area of 29,354 sq.km has a vast network having 11kV network of 35719 Ckm & LT network of 53941 Ckm. 8m, 9m & 11m PSC poles as well as WPB poles has been used majorly in these networks. There have been several irregularities in the span length of these networks where the span length ranges from 70m to more than 100m at some places. These large span lengths have resulted in a) Sagging of conductors, b) Low ground clearances - vertical clearance of conductor from ground is lower than the permissible limits of 5.5 m (for LT Lines) and 5.8 m (for HT Lines) and c) Accidents due to sagging & low ground clearances.

- **Need of Project**

To overcome such scenarios, where the span length is on the higher side, it is of utmost important to provide intermediate poles in between the spans. Addition of intermediate poles will address the issue of sagging, low ground clearances & accidents caused due to this.

Proper upkeep of the feeders is important for ensuring safety and reliability of power supply. During site visits, it was observed that most of the 33kV / 11kV / LT feeders are in deteriorated condition and pose safety threat to the human beings and animals. Most of the feeders have binding wire / multiple joints. As a result, there are chances of snapping of conductors and subsequent electrocution of human beings / animals since cradle guards are not provided. Due to scarcity of staff and materials, there is no structured maintenance planning. Tree branches / creepers are coming in contact with live conductors at many locations. Huge number of tripping's are reported on 33kV and 11kV feeders in previous years. With poor condition of network and absence of maintenance activity, it is difficult for utility to ensure reliable and quality power supply to the end users. During site visits, it has been observed that conductor of different sizes is being used in different phases which limits the circuit capacity. Moreover, over sagged wires in 33kV or 11kV feeders are posing major threat to the lives of human beings and animals. At some places, due to re-construction / widening of roads, vertical/horizontal clearances of the feeders have been reduced. This is not only causing violation of statutory guidelines but also increasing the chances of accidents.

- **Proposal for CAPEX Investment**

To ensure safety and reliable power supply to end consumers TPCODL proposes refurbishment of 33kV, 11kV and LV lines in phase manner emphasizing critical areas such as

schools, hospitals, markets and other key installations. The estimated capital expenditure for the scope of work envisaged for FY 2022-23 is as follows:

Table 46 : Capital Expenditure on Intermediary Poles

Sl. No.	Description	Quantity (In Nos)	Amount (Rs Cr)
1	13mtr WPB Poles	400	2.41
2	11mtr WPB Poles	426	2.12
3	9mtr PSC Poles	436	0.47
	Total		**5.00**

- **Benefit**

In many locations of transmission and distribution network of TPCODL, the span length is much more than standard limits as mentioned above. This leads to statutory violations of vertical clearances, as per guidelines. With use of interposing poles at low clearance locations statutory compliances can be met and hence safety of employee, public and animals will be enhanced, reducing the chances of electrocution.

4.1.5 Procurement of Testing Equipment and Test Lab development

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 were planned to be developed in Cuttack with new test bench facility. Most of the testing equipment have been purchased and also Civil Works have been completed. This is planned to be operational from 1st January, 2022 and in subsequent years, it is planned to bring it under NABL umbrella.

In CAPEX FY 2022-23, it is proposed to procure equipment like megger, Clamp-on meter, onsite testing kit, toolbox and JSA manuals amounting to Rs 0.33 Crs, for the testing lab. Also Rs 0.32 Crs is proposed as Safety Training expenditure which includes both setting up of infrastructure for training purposes and also associated expenses during trainings.

The tables below provides the tentative cost for equipment of MMG Lab, training expenditures etc. The total cost of refurbishment of one labs will be **Rs 0.65 Cr** as shown below:

p

Table 47 : Capital Expenditure on Testing Equipment

ITEM	Qty	Unit Cost (Rs)	Total Cost (Rs Cr)
Megger	5	300000	0.15
Clamp On (Leakage-mA)	40	10000	0.04
Clamp On 1000A	40	8000	0.032
Portable phantom Kit(1ϕ/ 3ϕ) for onsite testing	5	100000	0.05
Tool Box - Lab	7	2000	0.0014
Total			**0.2734**

Table 48 : Expenditure on Training

Safety Training Expenditure / Infrastructure	Qty	Unit cost (Rs)	Total Amount (Rs Cr)	Remarks
Hands on Technical Training set up	12	170000	0.204	One location per Division.
Portable Resistive Load of 3 KW	52	2500	0.013	Two set per division and 2 set per MRT lab
Total			**0.217**	

- **Conclusion**

As TPCODL is focusing on “Safety First” ideology, this budget will be utilized for development of training facilities for skill enhancement of Officer of TPCODL and BAs staff. This will also be used for developing storage space for keeping safety training equipment and demo of various generation of meters for training of BAs on how meter are to be installed, training on Meter reading and demo of working of Smart Meters. This facility will also be sued for training on trouble shooting of AMR modems and Smart Meters NIC.

4.1.6 Installation/ Construction of Plinth and Boundary wall Fencing of DSS

Scheme Proposed	Installation of Boundary Wall Fencing (5x4metres, 1.2 metre-height) Repair of DSS Plinth
Capex Amount	Rs 3.5 Crs
Benefit to customer	Improving the safety of people & stray animal Improving safety of the equipment

At many of the places it was found that the condition of the Boundary wall of DSS was in a very poor and unsafe condition. Distribution Substation are located at various locations catering the power supply requirement to the consumers. 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 and also transformer plinth is either damaged or not exists thus posing safety threat to stray animal and public at large. Ensuring safety of people & equipment is one of the core values of TPCODL. Hence it is proposed for Construction of Boundary wall and plinth for the DSS wherever required.

For Fencing, in CAPEX FY 21-22, Rs 1.82 Crs budget was approved by Hon'ble Commission for Boundary Wall (80 No.s costing to Rs 0.81 Crores) and FRP Fencing (120 No.s costing to Rs 1.01 Crs), which is expected to be completed by March' 2022. The cost estimates for scope of work in FY 2022-23 is as follows:

Table 49 : Capital Expenditure on Boundary Wall /Fencing

Sl. No.	Description	Quantity (Nos)	Amount (Rs Cr)
1	DTR Plinth	74	0.2
2	Fencing	359	3.3
	Total		**3.5**

4.1.7 Stores - Water hydrant system & Intrusion Detection System

Currently TPCODL is having storage facilities at 3 locations – Bhubaneswar, Choudwar and Jalna. The Stores house several materials such as transformers, cables, conductors, poles etc. Items like transformer oils, paints, wood etc are inflammable in nature and any small spark also may lead to severe explosion and fire may break out.

For precautionary measures, it is important for every storage area to have fire extinction arrangement. For compliance of the same, installation of water hydrant system is proposed for CAPEX FY 2022-23, so that for any emergency situations of small fire break out, water sprinkler system will be activated and in case of big fire, fire hydrant system will be activated. For the above activity, an amount of Rs 2 Crs is proposed under CAPEX FY 2022-23.

4.1.8 Testing Equipment for Operations

- Background

TPCODL has been agile in the adoption of latest technology in the power utility sector. Together with its culture of Consumer Service Excellence, Continuous Learning, Performance Orientation, Innovation and Empowerment; TPCODL is eager to set benchmarks in accelerated reduction of AT&C losses, improve power reliability, enhance consumer satisfaction and improve employee productivity. In this regard, testing of electrical equipment is one of the major jobs of a power distribution utility. This testing decides healthiness of equipment with the passage of time.

- **Business Objective**

After taking over the electricity distribution business from erstwhile CESU, one of the major operational challenge in front of TPCODL was to provide uninterrupted power supply. The expectation of consumers' kept on rising continuously with the improvement in power reliability over period of time. Meeting the regulatory targets of improving AT&C loss along with reliability and safety improvement is also one of the foremost requirement of TPCODL.

- **Justification**

TPCODL has a wide operational area of 30,000 Sq. Km, consisting of 5 Electrical circles & 20 Divisions. We have nearly 400 Nos. of 33/11kV substations with nearly 1200 nos. of PTRs along with 4200+ protective relays. Our jurisdiction has traditional as well as modern substation. The oldest substations are as old as 50years that has either electromagnetic or static type of relay.

The broader periphery required large number of testing kits for smooth operation of the utility. However, we have only 2 locations for the storage of equipment testing kit in Bhubaneshwar & Cuttack. We have very few numbers of working testing kits (Attached in Annexure - 54 nos. of defective testing equipment). Lesser number of testing equipment had impacted our swift responses in breakdown cases and thus resulted in consumer dissatisfaction along with unreliability and poor quality of power. Few of those kits are old, traditional and heavier in the range of 10-15 kg. Transportation of the heavy kits is one of the major concerns during the exigency breakdown condition. Due to presence of mechanical and electrical parts, there were few instances when long transportation has caused problems in the circuit because of damping and vibration.

Additionally, persisting fault in a network may cause failure of equipment and it is a major safety concern for lives. In the past, we were forced to charge the equipment in a hurry due to public agitation in the odd hours, that's also one of the major safety concern.

- **Proposed Solution**

Advanced testing kits will be provided on decentralized locations for better and quick response in the case of exigency. Enough amount of testing equipment will help us to monitor the healthiness of power equipment throughout the year. It will also help to take proactive initiatives in case of abnormalities in the trend of healthiness.

- **Scope of the Proposal**

Under the scope of proposal, we are looking forward to purchase standardized testing kits/equipment, calibration of the kits, distribution of the kits to each EMR office and providing training wherever required. Following no. of testing kits have been planned to be purchased in FY22-23 and the expenditure for the same is as given below:

Table 50 : Capital Expenditure for Testing Equipment

Testing Equipment	Quantity	Unit Rate	Total
Advanced Secondary Injection kit	1	3500000	3500000
CRM kit	6	153250	919500
Timer kit	6	350000	2100000
IR testing kit	120	50000	6000000
Power quality meter	1	400000	400000
Hi pot testing kit 40 KV	20	102000	2040000
AC hi pot testing kit	2	80000	160000
industrial grade laptops	5	150000	750000
Relay cable accessories	10	5000	50000
WRM	2	442500	885000
TTR	2	413000	826000
Leakage current meter	8	11292	90336
Tool Kit	100	6409	640900
Clamp on meter	180	4245	764100
Multi meter	180	10266	1847880
Hi pot testing kit 11 KV	120	51500	6180000
TOTAL			**27153716**
Grand Total With 18% GST			**32041384.88**

- **Proposed system after implementation**

There are few benefits from this scheme:

i. Downtime will reduce due to fast response in diagnosis of problem
ii. Reduction in ENS due to reduction in downtime.
iii. Reliability improvement of the network.

iv. Enhanced consumer delight due to improved reliability.
v. Reduction in overall equipment failure.
vi. Employee satisfaction due to reduction in repeated calls.
vii. Ease of monitoring of power equipment healthiness.
viii. Continuous monitoring of equipment will lead to enhanced lifecycle of equipment.

4.2 Yearly Schemes- Loss Reduction

The Various schemes for loss reduction envisaged for FY 2022-23 is as follows:

Table 51 : Break up of Capital Expenditure under Loss Reduction

Main Budget head	Sr No	Activity planned	Proposed Budget (Rs Cr)	Proposed in FY 2022-23
Loss reduction	10	Replacement of LT Bare Conductor with LT AB Cable (720 Ckt KM)	20	20
	11	Defective Cable Replacement	11	11
	12	Procurement for Mobile Phone & Blue Tooth Printer for new Upcoming SHG & TPCODL staff	1.25	1.25
	13	Cable for installation of DT Meter (4.46 Crs) and Feeder Meter Installation (3.86 Crs)	8.32	8.32
	14	Smart Meter as per (Approved budget)	23.55	23.55
	15	SAP AMI license for AMI Deployment	10	10
	16	**Total**	**74.12**	**74.12**

4.2.1 LT Bare to LT AB Cable conversion

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. 20 Cr.
Proposal for the Capex investment	351 km of LT bare conductor planned to be converted to AB Cable.

- **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 experiences frequent fault. These bare conductor lines are more subject to electricity theft through direct hooking and thus causing revenue leakage in the system. Though, bare conductor is easier to maintain and faster to restore during any fault but at the same time, it requires more clearances.

- **Need of this Project**

Frequent tripping can be avoided by use of aerial bunched insulated cables instead of bare conductors. Theft of electricity through hooking will be reduced leading to lower AT&C losses. 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.

- **Cost Estimate**

The cost estimates for Capital Expenditure for such expenditure is as follows:

Table 52 : Break up of Capital Expenditure for conversion of LT Bare cable

Sl.No	DESCRIPTION OF WORK	Unit	Price (Rs/Unit)	Qty in km	Total Amount
1	Conversion of LT Bare to LT AB Cable (4X95 sq.mm)	Km	0.084	26	2.184
2	Conversion of LT Bare to LT AB Cable (4CX70 sq.mm)	Km	0.07	63	4.41
3	Conversion LT Bare to LT AB Cable (4CX50 sq.mm)	Km	0.058	140.5	8.149
4	Conversion LT Bare to LT AB Cable (4CX35 sq.mm)	Km	0.052	55.5	2.886
5	Conversion LT Bare to LT AB Cable (2CX35 sq.mm+1CX35 sq.mm)	Km	0.039	60	2.34
	Total			**345**	**19.97**

- **Benefits**

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:

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

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.

- **Conclusion**

A total of 1500 CKm have been identified by TPCODL for bare to AB conversion for reduction of AT&C Loss of the System, which is planned to be executed in a phase-wise manner. In CAPEX FY 21-22, 240 km of LT bare conductor was approved by OERC for conversion to AB Cable. The total approved budget was Rs 12.12 Crs and in FY 2021-22 CAPEX TPCODL is proposing for a budget of **Rs 19.97 Crs.**

4.2.2 Defective Cable Replacement

- **Need of Project**

While replacement of defective and Mechanical meters and inspections during enforcement activities, it is found that cables are having joints / damaged which becomes a source of theft of electricity and safety hazard (electrocution of consumers). This budget is required for replacement of such identified damaged cables and accessories (Seals, Push fit type meter box) required while replacement of cables.

- **Benefit**

Replacement of the cable will help in reducing AT&C loss level and will make electrical system in consumer system safe.

- **Conclusion**

For Capex of FY 2020-21, a budget of Rs 13.65 Crs was approved by the Hon'ble Commission for this activity and in Capex FY 2021-22, a budget of Rs 3.77 Crs was approved by OERC. Under Capex FY 22-23, TPCODL would like to propose for a budget of **Rs 11 Crs**.

4.2.3 Cable for installation of DT Meter and Feeder Meter Installation

To install Smart meters on DTs, compact type meter box design is envisaged for DT of rating 100 KVA and 250 KVA. For installation of cable from DT LT Bushings to Meter Box incoming

and thereafter to LT Breakers or to LT Line, TPCODL is proposing for a budget of Rs 4.46 Crs under CAPEX FY 22-23.

Under CAPEX FY 22-23, Rs 3.86 Crs is proposed for procurement of Smart HT meters and metering equipment, for installation at Feeders metering points to ensure Energy Audit.

In all, a total of Rs 8.32 Crores has bene proposed under this head.

- **Benefit**

This will help in doing Energy Audit feeder wise and DT wise with more precision and near real time once all Smart Meters are in place. This will also make pathway for Sections wise Energy Audit in upcoming years.

- **Conclusion**

Under this category, Rs 15.36 Crs, has been approved by OERC under CAPEX FY 20-21. However, In CAPEX FY 21-22, no budget was proposed for this activity by TPCODL.

4.2.4 Smart Meter Implementation

This component is required for IT back end development of Smart Meters which has already been approved “in-principle” by Hon’ble Commission vide order under Case No. 32/2020. This budget will be used to develop DC and DR of Smart Metering project back end IT system .i.e. HES, MDMS and other IT communication hardware equipment and software required to run the hardware along with project management software.

As per roadmap already approved by OERC, for FY 2020-21, approved budget was Rs 15.36 Crs, for FY 21-22, it was Rs 47.6 Crs and for FY 2022-23, it is proposed to incur a budget is Rs 23.55 Crs.

4.2.5 SAP AMI license for AMI Deployment

This component of budget will be utilized for procurement of SAP AMI license as this is an mandatory component of AMI system, without which many functionalities of AMI cannot be integrated and make it a sngle integrated system with billing. The Proposed budget for CAPEX FY 22-23 is Rs 10 Crs.

4.3 Yearly Schemes- Reliability

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.

TPCODL license area is spread over a geography of 29354 sq.km and serve the registered consumer base of 2.6 million. TPCODL procures power from GRIDCO which is a state owned company, engaged in the business of purchase of electricity in bulk from various generators located inside Odisha and the state share of power from Central generators for supply in all power distribution utilities, including TPCODL. It receives electrical power at a sub transmission voltage of 33kV from Odisha Power Transmission Company Limited's (OPTCL) 220/132/33kV Grid Substations and then distributes the power at 33kV / 11kV / 440V / 230V depending on the demand of the consumers. For effective operations; license area is divided in 5 circles which is further sub divided in 20 Divisions and 65 Sub divisions which manages the commercial and O&M activities in order to serve its consumer.

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 33kV and 11kV 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, absence of LA, AB Switches, etc. This impacts reliability

TPCODL intends to implement the following actions to improve the reliability of power supply:

- Identification and replacement of faulty equipment causing frequent tripping's.
- Identification and commissioning of new equipment which are required as per industry standard.
- Introduction of technology to ensure faster restoration of supply in case of any tripping.

Below is the activity wise budget break up proposed for CAPEX FY 2022-23 :

Table 53 : Capital Expenditure for improving Reliability of the System

Main Budget head	Sr No	Activity planned	Proposed Budget (Rs Cr)	Proposed in FY 2022-23
Reliability	17	GSAS : SCADA enablement of conventional substation (Already Approved)	23	23
	18	Electronic Earthing System		
	19	Strengthening of Substation Automation Infrastructure,	5	5
	20	Deployment of New SCADA System to Setup MCC & BCC (Already Approved)		
	21	GSAS Automation - STS (PSS equipment replacement)	10	10
	22	33KV Network Infrastructure (New Feeder, Feeder Augmentation, Feeder sectionalization, N-1 for 33KV Consumer etc)	18	18
	23	Sick Equipment replacement (33KV & 11KV)	5	5
	24	11KV Network Infrastructure (New Feeder, Feeder Augmentation, Feeder sectionalization, N-1 for 11KV Industrial area, 11KV B/C at Industrial PSS, 11KV AB switch etc)	20	20
	25	AR, FPI, RMU, MCCB 160A, MCCB 500A	15	15
	26	33KV Feeder refurbishment	7	7
	27	FLC & Switchgear Workshop Equipment	7	7
	28	Earthing	1.8	1.8
	29	Mobile DT	1	1
	30	**Total**	**112.8**	**112.8**

4.3.1 Grid Station Automation System (GSAS) : SCADA enablement of conventional substation with Electronic Earthing

- **Background**

TPCODL has been in the forefront in the adoption of latest technology in the power utility sector pan Odisha. Together with its culture of Consumer Service Excellence, Continuous Learning, Performance Orientation, Innovation and Empowerment, it has been able to set benchmarks in accelerated reduction of tripping, equipment failure, enhance consumer satisfaction and improve employee productivity.

One of the significant challenges that the utilities face is restricting the fault at minimum possible section of the electrical network and clearing the fault in minimum possible time. To achieve this feat and utility works round the clock to minimize equipment failure, equipment down time and faster restoration thus ensuring reliability and enhanced MTTR. All the utility across the globe moving towards deployment of smart grid in order to ensure above mentioned goals. Going towards that direction, TPCODL deploys GSAS (Grid station automation system) in its working region – the very first step towards the direction of the integrated smart grid. TPCODL has already deployed GSAS in FY 20-21 and till now integrated 52 RAPDRP stations and 100 ODSSP stations from a centralized location in Bhubaneshwar and unmanned 35 stations overall and determined to unman another 65 stations by the end of FY 21-22. GSAS being a budget influenced project for any utility it is being divided into phases over the several financial years, as follows

I. Phase 1: FY 20-21: Integration of 52 RAPDRP stations, 4 PNP stations and 54 ODSSP stations
II. Phase 2: FY 21-22: Integration of 80 ODSSP stations and 22 conventional old stations in urban areas
III. Phase 3: FY 22-23: Integration of 67 conventional old stations spread across TPCODL area covering BBSR1, BBSR2 and Cuttack
IV. Phase 4: FY 23-24: Integration of rest of the stations spread across TPCODL area including rural stations of Dhenkanal and Paradeep.
V. Phase 5: FY 24-25: Left over stations of rural areas, if any.

So for FY 2022-23, in Phase 3, we need to enable automation of 67 old conventional stations through GSAS so that we get maximum reliability, minimum MTTR, asset life expansion by avoiding catastrophic charging and savings on manpower deputation.

- **Need of the Project**

After taking over the electricity distribution business from erstwhile CESU, one of the major operational challenges in front of TPCODL was to improve the reliability of power supply. Consumer's expectation kept on rising continuously with the improvement in power reliability over period of time. Meeting the regulatory standards is also one of the foremost requirement under regulatory framework and implementation of GSAS comes in an integrated package of involvement of less manpower, smart utilization of asset, quick decision making, automated remote monitoring and control along with state of the art asset management. In FY 20-21 we had unmanned 39 stations as on date, this enabled following

i. Quick decision making for restoration of faults
ii. Fact based energization/ restoration
iii. Centralized PSCC taking all the decisions for charging/ restoration
iv. Human intervention free system at sub-station level
v. The unmanning substation provided required manpower for manning other stations as per statutory requirement
vi. Safety for operators/ public who were visiting sub-stations for complaint/ operation/ commercial purposes.

- **Statutory compliance requirement**

As per the statutory compliance TPCODL is subjected to closure of complaints as per PA time line. Not only that, it is also directed that no sub-station to be manned without 7 operators round the clock. These two requirements are double edged saw taking a significant budget on manpower resources of TPCODL. On the other side many of our new and old stations are lying unmanned due to manpower crisis. GSAS comes as handy solution to these clauses of the statutory compliances. Along with this GSAS in conjunction with APSCC and CPSCC at the backup will play an impeccable role in unmanning our sub-stations and restoration of supply even before PA timeline.

- **Proposed Solution**

There are large number of sub-stations where considerable MUs are being lost with significant number of tripping and with informal trial closing. Keeping in view of remarkable improvement in terms of reliability and MTTR under 1st phase of unmanning of 51 stations till now, we would like to request the Hon'ble Commission to kindly consider for GSAS for 67 stations of Industrial, Urban and Semi urban areas phase-3. This would lead to further improvement of reliability and MTTR with strategic trial closing guidance leading to less equipment failure and adherence to the PA timeline. Along with this there will be huge saving in account of unmanning of the stations by allowing relocation of the available manpower to some other jobs.

- **Scope of the proposal**

TPCODL has taken an initiative for unmanning of the sub-stations recently. From time to time in past 3 months sub-stations were unmanned in step wise manner from 15 to 35 now. Primarily, 67 stations of Urban, Industrial and Semi urban categories are selected across TPCODL area for GSAS in FY 22-23 which will accelerate the future reliability indices of the system along with the unmanning of the stations in TPCODL area.

- **Cost Benefit Analysis**

<u>Tangible Benefits</u>

i. Improvement in power reliability and MTTR.
ii. Reduction in MU loss due to unwanted tripping's.
iii. Major difference will be APSCC supervised charging, thus
iv. Significant reduction in equipment failure due to repetitive charging
v. Unmanning of the stations in future course.

Intangible Benefits:

Installation of LDRs would definitely lead to increase the reliability of the power system network which would help to increase customer delight and thus loyalty.

- **Conclusion**

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 centre for efficient control and monitoring of electrical network.

SCADA enablement of 179 nos. of Conventional Substations has been planned to be implemented in phases i.e. 22 Nos., 67 Nos. & 89 Nos. of Substations in FY21-22, F22-23, FY23-24 respectively. The proposed solution will consist of Substation Automation System and 24V/48V DC System for the substation. Condition of DC System at Conventional Substations is very poor, hence it is planned to be replaced with a single DC system for Control Voltage and Automation.

In FY21-22 only 10 nos. of conventional substations with a budget of Rs 5.74 Crs were considered for SCADA enablement. However, this number was increased to 22 to accommodate all Urban, Semi Urban and Industrial Substations of Cuttack and Bhubaneswar Circle. Budget approved by board for SCADA implementation for GSAS is Rs. 23 Crs. Out of this, Rs 21 Crs is considered for financial year FY22-23 for 60 Nos. of Substations (48 S/s out of 79 S/S as per plan of FY 22-23 and 12 additional of FY 21-22 to accommodate all Urban, Semi Urban and Industrial Substations of Cuttack and Bhubaneswar Circle).

Separate Electronic Earthing System for Substation Automation equipment (RTU, Communication equipment). The proposal is for 200 nos. of Substation i.e. ODSSP and RAPDRP, with a budget requirement of 0.5 Crs. For RTU replacement at Substations (excluding Conventional Substations) for approx. 20 nos. of Substations proposed CAPEX for FY 22-23 is 1.5 Crs.

And a budget of Rs 10 Crs is proposed for PSS equipment replacement along with sub-station earthing, switchgear replacement etc.

Scheme Proposed	Strengthening of Sub-station Automation System through SCADA Enablement
Benefit to customer	1. Better Control and operation through Remote Operation. 2. Faster Changeover and quick restoration of Supply

4.3.2 Strengthening of Sub-station Automation System

In FY20-21 DPR was prepared and submitted to Hon'ble Commission for Rs 73 Crores to procure the new SCADA System with ADMS applications for entire TPCODL Distribution network. In FY21-22, Hon'ble OERC has approved only Rs 21.64 Crores. The balance amount of Rs 51.36 crores is proposed to be utilized in subsequent years in phase-wise manner.

Procurement of new SCADA System with ADMS applications for TPCODL Distribution network. Approximate budget requirement for placing order on M/s GE is Rs 20.4 Crores. Rs 15.4 Crores out of Rs 21.64 provisioned from FY21-22 approved budget.

Balance Rs 5 crores of M/s GE order is provisioned against board approval note of CAPEX FY22-23.

4.3.3 33kV System Improvement

Scheme Proposed	New 33kV line to optimize the feeder loadings, achieving N-1 contingency condition, avoiding feeder overloading.
Capex Amount	Rs. 18 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: ▪ Reliable power supply to the consumers ▪ Improving the circuit capacity by replacing the weaker section with appropriate sized conductor. ▪ By putting interconnectors, N-1 of the feeders will be ensured and load can be transferred to alternate source in case of any exigency.

In TPCODL, 33kV network is the backbone of 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.

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 33kV feeders.
- Absence of N-1 redundancy at least to critical installations.
- Circuit capacity restricted to lower size of conductor in existing line.

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.

Table 54 : Capital Expenditure for improving Reliability of the System

Sl. No.	Circle	Amt (Rs Cr)
1	BBSR-II	7.18
2	CUTTACK	1.79
3	DHENKANAL	4.59
4	PARADEEP	4.51
	Total Amount for 33kV Feeder Network Strengthening and N-1	**18.07**

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. 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. 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.

In CAPEX FY 2021-22, OERC has approved Rs 25.97 Crs under "33KV System Improvement schemes - Feeders and Power Evacuation from OPTCL" category and 8.37 Crs under "33KV System Improvement schemes - Equipment like 33KV RMU, Isolators etc". For this financial year, TPCODL is proposing CAPEX of 18 Crs for 33kV Network Instructure development.

4.3.4 33kV and 11kV Sick Equipment Replacement

Brief description about the	The Power distribution network & its equipment health is a critical factor for ensuring reliable & quality power supply to the end consumers.
Capex Amount	Rs. 5 Cr.

- **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.

- **Scheme Proposed**

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 year 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.

- **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.

- **Benefit**

TPCODL intends to implement the following actions to improve the reliability of power supply. Identification and replacement of faulty / sick equipment causing frequent tripping's. Introduction of new technology to ensure faster restoration of supply in case of any tripping.

- **Cost Estimate**

Table 55 : Capital Expenditure replacement of Sick Equipment (33 KV and 11 KV)

Sl. no.	Description	Qty. Considered under CAPEX 22'-23'	Total Cost (in cr.)
1	33 KV Isolator with Earth switch	16	0.28
2	33KV Isolator without Earth switch	22	0.22
3	11 KV Isolator with Earth switch	26	0.26
4	11 KV Isolator without Earth switch	20	0.17
5	33KV IND OG CRP:	14	0.68
6	33kv IND TRF CRP:	12	0.69
7	33kv BKR:	12	0.46
8	11kv IND CRP:	12	0.57
9	11kv IND VCB	6	0.33
10	11kv OD VCB	10	0.56
11	33kv OD C.T	50	0.34
12	11kv IND C.T	50	0.04
13	11kv OD C.T	30	0.14
14	11kv IND P.T	16	0.02
15	11kv OD P.T	22	0.11
16	33kv OD P.T	21	0.13
	Total		**5.00**

- **Conclusion**

In CAPEX FY 21-22, budget approved by Honourable OERC was Rs 13.40 Crs for 33kV and 11kV Sick Equipment replacement and 3 Nos of sick PTR replacement. Under CAPEX FY 22-23, TPCODL is proposing for a budget of Rs 5 Crs under this category.

4.3.5 11kV Network Infrastructure

Scheme Proposed	Conductor augmentation, new 11kV line to optimize the feeder loadings, achieving N-1 contingency condition, avoiding feeder overloading.
Capex Amount	Rs. 20 Cr
Benefit to customer	▪ Reliable power supply to consumers ▪ Improvement in reliability Indices like SAIDI & SAIFI.

- **Existing System in Place**

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.

- **Need of Proposal**

This scheme is proposed to give flexibility to the field teams in 11kV feeder operation. In this head, all such issues can be mitigated by:

i. Laying new 11kV feeders.

ii. Augmenting the existing 11kV feeder to address overloading issues of the feeders. This will help in strengthening the existing 11kV system.

- **Cost Estimate**

Table 56 : Capital Expenditure replacement of 11 KV Feeder Interconnection

11kV Feeder Refurbishment			
Sl. No.	**Description**	**Quantity**	**Amount (Rs Cr)**
1	11kV conductor refurbishment (100sqmm) (in Ckm)	122	3.3
2	Interposing poles (11mtr WPB Pole) (in nos.)	1220	6.07
	Total		9.37
Abstract of 11kV Feeder Interconnection			
1	Proposed length of line interconnection (100sqmm conductor along with DP without AB switch, DP with AB switch, cut point poles and pin point poles (in Ckm)	15	2.76
2	No. of interposing poles and DP with AB Switch		
i	No. of Interposing poles (in nos.)	185	0.92
ii	No. of interposing DP with AB Switch (in nos.)	3	0.06
3	No. of AB Switch (in nos.)	45	0.08
4	Proposed length of UG Cable along with jointing kits and LA (route length in km) (open trench)	4.5	6.07
5	3W 11kV RMU (LLV) along with 3C, 400sqmm UG Cable, jointing kits and LA.	3	0.49
6	11kV Bus section Isolator	6	0.12
7	11kV Bus Coupler (Indoor)	1	0.11
	Total		**10.62**

- **Benefit**

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. Thus will lead into lower interruption and good quality power hence leading to satisfaction of our consumers.

- **Conclusion**

The proposals of CAPEX FY 20-21 for 11kV Feeders to improve reliability and strengthen network, 67 numbers of RMUs has to be installed thus increasing the reliability of the consumers. Also Augmentation and New Line proposals of about 20 km are being proposed

thereby increasing the N-1 of the existing feeders and also augmentation of existing feeders for 27 feeders of Bhubaneswar and Cuttack City area.

For execution of the above plan, the Hon'ble Commission has approved a budget of Rs 18.99 Crs under "11kV System Improvement – Feeder and Equipment". For this fiscal year, 22-23, TPCODL would like to propose a budget of Rs. 20 Crs under "11kV System Improvement" category to the Hon'ble Commission.

4.3.6 11kV and LT System Protection

Scheme Proposed	To strengthen & make existing 11kV network more reliable, it is suggested to install Auto reclosures, sectionalisers, Fault Passage Indicators, RMU and MCCBs.
Capex Amount	Rs. 15 Cr
Benefit to customer	▪ Ease of operation to the field teams ▪ Improving the safety in terms of Equipment operation

- **Need of Project**

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 therefore to attend/work at LT feeder, outage to be taken from 33/11kV structure which results into interruption to all consumers connected to particular 11kV feeder.

Moreover, in city area, interconnectors & load break switch is required to address the issue of overloading, load shifting during exigencies & improving reliability.

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.

TPCODL would like to introduce communicable type Fault Passage Indicator, Auto-recloser & Sectionaliser. This will help in improving the reliability of the power distribution network.

- **Cost Estimate**

Table 57 : Cost of Protection Equipment

Sl. No.	Description	Quantity (in nos.) approved under FY 20-21	Quantity (in nos.) proposed for FY 22-23	Amount
1	11kV line DP with Auto Reclosure	40	28	3.25
2	11kV line DP with Sectionaliser	120	20	2.32
3	Fault Passage Indicator (FPI) without DCU	900	80	0.15
4	3W 11kV RMU (LLV) along with 3C, 400sqmm UG Cable, jointing kits and LA.	60	11	1.79
5	4W 11kV RMU (LLVV) along with 3C, 400sqmm UG Cable, jointing kits and LA.		2	0.43
6	LT Distribution Box with MCCB, for (MCCB-800A)		42	1.39
7	LT Distribution Box with MCCB, for (MCCB-500A)	360	155	4.16
8	LT Distribution Box with MCCB, for (MCCB-160A)	540	158	1.51
	Total			**15**

- **Benefit**

This will lead to:

i. Reliable power supply to consumers
ii. Improvement in Reliability Indices like SAIDI & SAIFI.
iii. Ease of operation to the field teams
iv. Improving the safety in terms of Equipment operation

With auto-reclosers and sectionalizers 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.

- **Conclusion**

In CAPEX FY 20-21, a budget of Rs 46.05 Crs has been approved by OERC. However, in CAPEX FY 21-22, this activity has not been considered. The proposed budget is Rs 15 Crs for CAPEX FY 22-23.

4.3.7 33kV Feeder Refurbishment

Scheme Proposed	33kV feeder refurbishment for reliable and quality power supply to consumers.
Capex Amount	Rs. 7.5 Cr
Benefit to customer	▪ Reliable power supply to the consumers ▪ Improving the circuit capacity by replacing the weaker section with appropriate sized conductor.

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.

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.

- **Cost Estimate**

Table 58 : Cost of 33KV Feeder Refurbishment

Sl. No.	Name of Circle	Cost (Rs Cr)
1	BBSR-II	2.5
2	CUTTACK	1.59
3	DHENKANAL	3.38
4	PARADEEP	0
	Total Amount for 33kV Feeder Refurbishment	**7.47**

4.3.8 FLC (Fault Locating Cell) & Switchgear Workshop

TPCODL's Fault Locating Cell has been carrying out routine activities of fault location without supply of adequate equipment.

These 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. The outage duration will also reduce thereby increasing consumer satisfaction.

In TPCODL network, at present we are having Ring Main Units which delivers reliable and quality power supply to its valuable customer based 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 cyclones which needs repair & replacement. TPCODL proposes to develop a state of art capability of 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, some equipment were approved by OERC under CAPEX FY 21-22 amounting to Rs 1.94 Crs in order to carry out routine activities under switchgear workshop. The below equipment 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 proposed budget for CAPEX FY 22-23 for FLC and Switchgear Workshop will be Rs 7 Crs.

Table 59 : Capital Cost of FLC

			FLC		
Sl no	Name of equipment	Qty	Unit Price with GST (18 % GST)	Total Price with GST	Justification
1	Advance van mounted HT cable fault locator with integrated VLF and cable diagnostics with 5 years warranty on equipment	1	₹ 3,50,46,000.00	₹ 3,50,46,000.00	TPCODL has a vast geographical area with large number of UG cable, presently FLC has only two FLC vans it has become very difficult to attend cable faults at different circle simultaneously resulting into undue stress to Van, costly equipment & manpower due to high frequency of movement of vans. Length of cable network is continuously increasing, more than 10km single run 33 kV cable is present. So advance cable fault locator van with latest technology is required to attend a lengthy 33 kV critical faults which otherwise is very difficult to pinpoint with existing equipment. Cable diagnostic equipment will help identifying sick cable and planning replacement
2	Vehicle mounted LT Cable Fault Locator with pin pointer	2	₹ 49,85,500.00	₹ 99,71,000.00	Length of LT network in TPCODL is continuously increasing, to attend LT cable fault quickly van mounted LT fault locators are required. 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.
3	Murray Loop/ High Voltage Bridge	1	₹ 22,42,000.00	₹ 22,42,000.00	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
4	Portable Time Domain Reflectometer	2	₹ 6,13,600.00	₹ 12,27,200.00	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.
5	Cable identifier	3	₹ 6,78,500.00	₹ 20,35,500.00	Cable identification is one of the very critical job before cutting a cable for repair or rerouting purpose. This equipment identifies intended dead cable in presence of other live cables.
6	Portable pin pointer (Digiphone+)	2	₹ 14,16,000.00	₹ 28,32,000.00	Pin pointers are used in field for locating exact location of fault, due to its continuous usage they are prone to malfunction so sufficient spare Digiphone+ are required with each fault locator equipment to cater during emergency
7	Insulation tester up to 2.5 kV for LT cables	3	₹ 2,06,500.00	₹ 6,19,500.00	Before proceeding for fault location on LT cables, small portable IR testers are required to check its insulation value.
8	Cable puncture tool kit	5	₹ 4,13,000.00	₹ 20,65,000.00	This is a very critical equipment used to puncture an identified cable for repair or re- routing cable. Before cutting of cable it is punctured remotely to eliminate the possibility of puncturing a live cable by human error. Thus it very important from safety point of view.
9	Cable route tracer for both online & offline operation along with GPS tracker	3	₹ 9,73,500.00	₹ 29,20,500.00	TPCODL has large number of old UG cable whose route & depth is not documented and are unknown. Due to ongoing infrastructure work by other agencies, it is often required to trace the UG cable before other agencies can dig into that area.
	Total of FLC			**₹ 5,89,58,700.00**	

Table 60 : Capital Cost of Switchgear Equipment

Switchgear					
Sl no	Name of equipment	Qty.	Unit Price	Total Price with GST	Justification
1	Oil Breakdown Voltage Tester for CSS	1	₹ 10,62,000.00	₹ 10,62,000.00	Oil healthiness checking of transformer during PM & breakdown maintenance.
2	Transformer Winding & Turns Ratio Meter	1	₹ 14,16,000.00	₹ 14,16,000.00	Transformer healthiness checking during PM & breakdown maintenance.
3	Ultra sound Partial discharge detector for Switchgear	2	₹ 7,31,600.00	₹ 14,63,200.00	For predictive maintenance of switchgears. Any loose connection in cable compartment, abnormal discharges can be detected.
4	Non-contact voltage detector up to 33 kV	6	₹ 1,41,600.00	₹ 8,49,600.00	Confirmation of absence of voltage after shutdown before starting of maintenance work
5	Digital Multimeter	2	₹ 29,500.00	₹ 59,000.00	Required for measurement of voltage by Switchgear team during maintenance
6	Digital AC/DC clamp meter	5	₹ 59,000.00	₹ 2,95,000.00	Required for measurement of current by Switchgear team during maintenance
7	PPE Arc flash suit up to 8 cal/cm2	12	₹ 11,800.00	₹ 1,41,600.00	Required for safety purpose during operation of LT switchgear & testing.
8	PPE Arc flash suit upto 40 cal/cm2	5	₹ 1,77,000.00	₹ 8,85,000.00	Required for safety purpose during operation of up to 33KV switchgear & testing.
9	Phase sequence indicator	3	₹ 47,200.00	₹ 1,41,600.00	Phase sequence checking before connection of cable
10	AC/DC leakage clamp on tester	3	₹ 59,000.00	₹ 1,77,000.00	For checking leakage current
11	Vacuum cleaner for CSS	3	₹ 29,500.00	₹ 88,500.00	Cleaning of CSS compartment, transformer & RMU
12	Blower for CSS maintenance	3	₹ 23,600.00	₹ 70,800.00	Cleaning of CSS compartment, transformer & RMU
13	AC Voltage detector up to 1000V 1set	1	₹ 53,100.00	₹ 53,100.00	For checking of LT voltage before connecting test equipment
14	Transport trolley for equipment	1	₹ 1,65,200.00	₹ 1,65,200.00	Trolley for equipment shifting
15	Insulated platform up to 45 kV for RMU & CSS maintenance	5	₹ 55,460.00	₹ 2,77,300.00	Platform for maintenance of CSS & RMU for roof top as well height job.
16	Auto recloser test equipment	1	₹ 35,40,000.00	₹ 35,40,000.00	For testing of auto reclosers & sectionaliser. TPCDOL has large number of autoreclosers and sectionalisers installed across its network which are defunct and non-operational due to lack of maintenance. We have planned to revive them and take them into service.
17	SF6 gas top up kit	3	₹ 1,18,000.00	₹ 3,54,000.00	For filling of SF6 gas in RMU & CSS wherever gas pressure is found low
	Total of Switchgear Equipment			₹ 1,10,38,900.00	

In CAPEX FY 2021-22, an amount of Rs 1.9 Crs were approved by OERC for FLC equipment. Under CAPEX FY 22-23, TPCODL is proposing for a budget of Rs 7 Crs.

4.3.9 Pipe Earthing

Scheme Proposed	Strengthening of the earthing system in power distribution system.
Capex Amount	Rs 1.8 Cr
Benefit to customer	▪ Lesser chances of fault ▪ Reliable power supply ▪ 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 meters 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

- **Cost Estimate**

Sl. No.	Description	Quantity Approved under CAPEX FY 21-22 (No)	Approved Budget	Quantity proposed for FY 22-23 (in Nos.)	Proposed Budget (in cr.)
1	Pipe Earthing	750	Rs 0.67 Crs	2447	1.80

Benefit

i. Lesser chances of fault
ii. Reliable power supply
iii. Equipment safety

4.3.10 Mobile DT

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 1.08 Cr
Benefit to customer	▪ Faster power restoration at time of DT failure ▪ Public Safety ▪ 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:

i. 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
ii. 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.
iii. 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.

- **Cost Estimate**

As per latest purchase price of mobile DT 500 kVA under approved budget of CAPEX FY 21-22, cost of each unit comes around Rs 0.216 Crs. Thus, for 5 Nos of 500kVA mobile DTs, approximate cost will be Rs 1.08 Crs.

- **Benefit**

i. Faster power restoration at time of DT failure
ii. Public Safety
iii. Lesser Road Congestion

- **Conclusion**

In CAPEX FY 21-22, OERC has approved a budget of Rs 1.9 Crs for 9 Nos of Mobile DTs. These are planned to be used in city area of TPCODL. Further, for CAPEX FY 22-23, TPCODL has proposed for a budget of Rs 1.08 Crs for procurement of 5 nos of mobile DTs.

4.4 Yearly Schemes - Load Growth

The overall capital Expenditure under this head is a given in the table below:

Table 61 : Capital Investment in Load Growth

Main Budget head	Sr No	Activity planned	Proposed Budget (Rs Cr)	Proposed in FY 2022-23
Load Growth	31	Network augmentation / addition to meet load growth	10	10
	32	Power Transformer Addition / Augmentation	10	10
	33	DT Augmentation	5	5
	34	**Total**	**25**	**25**

4.4.1 Network augmentation / addition to meet load growth

Scheme Proposed	In order to meet this growing load, 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. It is also observed that while extending supply to the single phase consumers i.e less than 5 KW, the expenditure incurred by TPCODL is much higher than the amount paid by the consumer for extension of supply (Service Line charges). The amount under this head would also cover the differential amount i.e amount incurred less amount recovered under this situation
Capex Amount	Rs 10 Cr.
Benefit to customer	Better the availability of materials, faster will be process of providing new connection hence more will be the customer satisfaction

4.4.2 Power Transformer Addition/ Augmentation

Brief description about the Scheme Proposed	To cater the increasing load demand, PTR augmentation is required to avoid any overloading and N-1 fail situations. Also to ensure reliable power supply to our consumers, PTRs have to be kept at optimum loading so as to avoid any mechanical stress on the transformers due to overloading. To avoid any overloading issues, especially in urban areas where the load growth is high, TPCODL has undertaken the assessment of the loading of the power transformers and found that to meet the estimated Summer'23 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 Existing log sheet data 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 10 Cr.

	Under this same category approved CAPEX in FY 21-22 was Rs 13.2 Crs
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.

4.4.3 DT 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 have 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 80% 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 5 Crs The break up is as follows: **Table 62 : Capital Cost for Augmentation of Transformers**

Description	Qty. FY 21-22	Approved FY 21-22 (Rs Cr)	UoM	Proposed Qty FY 22-23	Estimated Total Amt. (Rs Cr)
Installation of 250KVA, 11/0.4KV to mitigate Overloading	30	1.78	No.	45	2.66
Installation of 500KVA, 11/0.4KV to mitigate Overloading	24	2.79	No.	20	2.32
Total	54	4.57		65	4.98

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 80% 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 occurs 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 54 Nos of DTs have been augmented in CAPEX FY 21-22 amounting to 4.57 Crs and for CAPEX FY 22-23, we are proposing an amount of Rs 4.98 Crs for 45 Nos 250 KVA and 20 Nos of 500 KVA DT augmentation.

4.5 Yearly Schemes -Infrastructure

The Capital Expenditure for capital expenditure under this head is as follows:

Table 63 : Capital Cost for Infrastructure Development

Main Budget head	Sr No	Activity planned	Proposed Budget (Rs Cr)	Proposed in FY 2022-23
Infrastructure	35	PSCC Infrastructure	0.06	0.06
	36	Technology Centre	15.4	15.4
	37	IT infrastructure	11.5	11.5
	38	IT - Communication (Already approved)	2.7	2.7
	39	GIS (Already approved)	33	33
	40	Civil	13.49	13.49
	41	Transformer Repair Workshop Equipment	1	1
	38	Ready to use office assets (Furniture & Fixture)	1.5	1.5
	39	**Total**	**78.65**	**78.65**

4.5.1 Infrastructure for PSCC

- **Existing System in Place**

At present 8 divisions across 3 circles are being remotely operated at PSCC including 11KV and 33KV operations. PSCC operates with 8 workstations and 7 mobile sets as of now.

- **Need of Project**

The focus areas catered by PSCC are 33KV remote operations (Central Power System Control Centre, CPSCC), 11kV remote Operations, Area Power System Control(APSCC), Unmanning, Load Forecasting and Disaster Management as Central Emergency Control Centre (CECC) to improve safety and achieve operational excellence as a part of organizational values and mission.

To cater to these vital areas and additionally to migrate to remote operation coverage area from BBSR1 and Cuttack to other circles and CPSCC operation of other circle grids, PSCC employee strength has increased which has resulted in need of infrastructure development.

- **Proposal for CAPEX Investment**

With the current infrastructure, it will be difficult to cater to the requirement of PSCC, APSCC and CPSCC expansion. So it is proposed for an investment in improving the infrastructure.

- **Scope of Proposal**

The scope of this proposal includes investment for

i. Extra required furniture
ii. Extra lockers for new engineers
iii. Additional work station for operating new division PSS and monitoring APSCC
iv. Extra Mobiles for new operations
v. Sound absorber mat
vi. Automatic Sanitizer Machine exclusively for PSCC
vii. Helmet and Bag stand for improving aesthetic look of control room

- **Cost Estimate with Execution Timelines**

Table 64 : Capital Cost for PSCC Infrastructure

Requirement	Cost Estimate (In Crs)	Execution Timeline
Furniture	0.01	Immediate use
Lockers	0.02	Phase wise distribution as per new engg joining
Work Station	0.015	Phase wise set up as per take over for remote operation and APSCC
Mobiles	0.0075	Phase wise use as per take over for remote operation and APSCC
Sound absorber Mat	0.0025	Immediate use
Sanitizer	0.0025	Immediate use
Helmet and Bag stand	0.0025	Immediate use
Total	**0.06**	

- **Proposed System after Implementation**

With implementation of above said features, each division monitoring/control will be done from one individual work station with an associated system for PTW. Each workstation operating one individual division will have a dedicated mobile which will in turn increase the efficiency of operation. Each circle APSCC monitoring will be done. CPSCC migration to other circle grids with expansion of 11KV remote operation to other divisions,

- **Cost Benefit Analysis**

After implementation of the above stated infrastructure, following intangible benefits will be there:

i. Ease of operation for desk engineers
ii. Reliability improvement
iii. Ease for the field people during PTW request and other required operations
iv. Operation without any health hazards

- **Conclusion**

Considering the above stated analysis and for the benefit of our employees operating towards achieving the organization mission, the requested CAPEX investment is quite justified and should be approved.

With more stations being enabled for operation through SCADA, the number of workstations for PSCC operations will have to be increased. Therefore, more will be the requirement of manpower to operate in shift duties. Employees working in shift duties will require lockers. Also with increase in number of work stations, more mobile handsets will be required for day-to-day communications with field.

4.5.2 Implementation of Technology Center for all the Four Discoms of ODISHA

- **Introduction:**

Tata Power and its subsidiaries have 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. DISCOMs are using and planning to implement various technology i.e. IT systems such as SAP-ERP, Mobile Apps, Collection Module, BW HANA Appliance, Smart Metering, Big Data, GIS and e-Office etc. and OT Systems such as Supervisory Control and Data Acquisition (SCADA) & Advanced Distribution Management System (ADMS), Substation and Field Automation etc.

- **Implementation of Technology Centre:**

To serve customers through digital platforms and to provide seamless support to Operation Services for different processes towards management and control, ensuring 24x7 availability is essential and hence, need to setup the Technology Centre at each Discoms. These Technology Centres will have OT Infrastructure (MCC), wherein all application servers are to be placed with optimized support team members to monitor, manage as well as work continuously for streamlining the process of critical OT systems.

All the four Discoms of ODISHA i.e. TPCODL, TPSODL, TPNODL & TPWODL are in the process of implementing SCADA/ADMS system in respective licensed area with the concept of Main Control Centre and Backup Control Centre. The Main Control Centre is planned to be established in the respective headquarters Technology Centre, whereas Backup Control Centre is planned to be established at other geographical location in the state.

It is proposed to establish OT Backup data Centre of TPWODL, TPSODL, TPNODL at Technology Centre of TPCODL Bhubaneswar, ODISHA. Whereas the OT Backup Control Centre of TPCODL is planned to be established at Technology Centre of TPWODL, Sambalpur.

It is worth mentioning that as shown below in tabular format, Main data Centre for IT Applications and infrastructure of all four Discoms is proposed to be established at Technology Centre, Bhubaneswar and Disaster Recovery Centre at Technology Centre, Sambalpur to ensure seamless business continuity.

Similarly, the Technology Centre at Sambalpur will accommodate OT Main Control Centre of TPWODL, OT Backup Control Centre of TPCODL and IT Disaster Recovery Centre for all four Discoms.

Technology Centre	TPCODL		TPWODL		TPSODL		TPNODL	
	IT	OT	IT	OT	IT	OT	IT	OT
Bhubaneswar	Main	Main	Main	Backup	Main	Backup	Main	Backup
Sambalpur	Backup	Backup	Backup	Main	Backup		Backup	
Berhampur						Main		
Balasore								Main

- **Need of Disaster Recovery Centre:**

As per International and industry standard and guidelines, utility must have Disaster Recovery Centre / Backup Control Centre to mitigate any eventuality in case of any emergency such as Cyclone, Earthquake, Cyber Attacks, Fire, Terrorist attack etc.

This facility will enable business continuity by ensuring data protection, data backup, and continuity of the critical services and remote monitoring & control of power system along with the following benefits.

i. Effective sustenance of critical applications
ii. Centrally addressing the business needs for digitization, business users and customers
iii. Improved availability of critical applications along with network
iv. Resource & Auxiliary System optimisation and Cost minimisation
v. Seamless System Integration, better Security and Administrative Management
vi. Enhanced Customer Satisfaction

- **Benefits of investing in Technology and Technology Centres**

Benefits to Customer

i. Reduction in restoration time of outage
ii. Improved power quality and reliability of service
iii. Real-time dissemination of information regarding outages and Expected restoration duration.
iv. Helps in planning the network augmentation for reliability
v. Timely Bill to the consumers
vi. Various payment avenues for the ease of consumers
vii. Centralised Call Centre to serve the consumers effectively.

Benefits for the Discoms

i. 360-Degree visibility of Consumers and system information
ii. Real-time status of activities and performance measurement
iii. Centralised MIS for review by Leadership Team and the regulator
iv. Standardisation of policies, processes and practice
v. Shall bring transparency in the transaction
vi. Optimisation of resources and inventory
vii. Auditable system
viii. Improvement in reliability of power supply
ix. Enhanced operational safety
x. Centralised Remote monitoring & control of Distribution Network.
xi. Faster restoration, optimal use of energy, better load forecasting, planned outage management.
xii. Reduction in maintenance time & enhanced equipment life
xiii. Improvement in Revenue realisation for sustenance
xiv. Availability of information anywhere and anytime
xv. Ease of access from remote location via secured connectivity enabling Work From Home

Proposal:

It is proposed to build a new "**TECHNOLOGY CENTRE**" at Power House, Unit 8, which shall house IT & OT Data Centre, Centralized Power System Control Centre and office space for IT, OT, GIS and PSCC along with other basic facilities. The new Building shall be G + 2, built upon land measuring 60 m X 46 m, having a built up area of 1104 Sqm (34.5 m X 32 m) and a floor area of 3312 Sqm. The building shall primarily house:

- **IT/OT servers** – catering the critical applications of IT & OT more servers will be required and deployed along-side the current server infrastructure.
- **Battery and UPS room:** To be established separately (due to safety aspect) for catering to the entire IT/OT infrastructure. Since UPS rooms are prone to fire and other unwanted calamities, it is proposed to locate separately as per industry standards.
- **Communication/Network Operation Centre (NOC)**: In order to cater the all critical business function, the availability of the secured network is must and it is important to protect our network and continuously monitor the performance, security and health of IT network. For this we need to deploy NOC.
- **Security Operation Centre (SOC) for IT & OT**: More and more IT applications and services are being exposed to internet in order to make employees, consumers, vendors and other stakeholders to work from remote / home and ensure the continuity of business in unforeseen situations e.g. any natural disaster, global pandemic like COVID -19 etc. Accessing and using IT applications and services through internet poses the risk of Cyber-attacks. This increases the probability of penetration into our network with cyber-attacks by unauthorized users / hackers resulting in disruption of critical business processes. In order to handle the attacks proactively, we need to create an environment in our organization wherein we could simulate the attack scenarios and vulnerable situations and empower our employees to detect and respond to the same. Therefore there is a need or Security Operation Centre.
- **Centralized Simulation & Training Centre for OT (DTS):** To empower the employees with current business objective so that they can acquire new skills, sharpen existing ones, perform better, increase productivity and support business efficiently, there is a need of centralized training centre.
- **Central Power System Control Centre:** PSCC system presently located at the current location caters customer with power supply 24x7 by central monitoring of 11 KV and above feeders and automated grids for all outage interruption and maintenance related facilities.
- **DG Set:** DG sets are used as emergency power-supply as well as for more complex applications. These DG sets will have separate area so that normal functioning of the office employees does not get interrupted.

To support the above mentioned aspects, around 150 employees shall be engaged in the Technology centre. Further, it is proposed to deploy the Technology Centre at TPCODL shall estimate a budget **Rs 15.30 Cr.**

Timeline: For the redevelopment of the infrastructure and deployment of Technology Centre, project shall nearly take 1 to 1.5 years.

It is worth mentioning here that currently, TPCODL DC is set up at Kalyani Complex, DC for other 3 Discoms is set up at OPTCL and IT Team has occupied a floor at another rented place. For these places, total annual rental cost is around **Rs 2.84 Cr** *[Rs 1 Cr for TPCODL DC + 0.4 Cr for office space for IT Team + Rs 1.44 Cr for other 3 Discoms DC at OPTCL as per current market rate]*. Moreover, DC should be set up in own building which is planned to be certified as Green Building and for the same, preliminary background preparation has been done to make the Technology Centre ready at the earliest. On approval of this proposal, ROI shall be achieved in 5.4 years.

4.5.3 IT Infrastructure

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 was on making the Network more robust, theft free and more secured. For the same, it was required to implement latest & updated versions of Firewall, Antivirus, eMail Spam protection systems etc. Further, there was 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 , it was planned for Fiber Connectivity between the two cities. Approved budget from OERC for CAPEX FY 21-22 for IT Infrastructure, to cover a part of the activities mentioned above, is Rs 21.64 Crs.

For CAPEX FY 22-23, TPCODL would like to propose an amount of Rs 12.7 Crs for the activities as listed below:

Table 65 : Capital Cost for IT Infrastructure

Activity	Budget in Crs
Backup system of additional system.	2
DIGI Gov E-Office solution	5.5
Smart Store ware house management system	1.5
Laptop	1.4
LAN Equipment and LAN work at Remote Offices	1.2
MS Products - 500 Users	1.1
Total	**12.7**

4.5.4 Communication Network

This scheme ("Road Map" Scheme) was approved under the Order in Case No 5 of 2021 and an amount of Rs 4.73 Crores was approved for FY 2021-22. For FY 2022-23 a budget of **Rs 2.7 Crs** is proposed to strengthen the communication network.

4.5.5 GIS Roadmap Implementation

For implementation of GIS Roadmap, OERC has already approved an amount of Rs 52.79 Crs. Out of the total approved amount, 2 Crs have been utilized in CAPEX FY 20-21, Rs 17.32 Crs have been approved for utilization in FY 21-22. TPCODL is proposing for approval of the rest of the budget of Rs 33 Crs.

Out of this total budget, Rs 26 Crs is planned to be utilized for Survey and Consumer Indexing of 3 Circles – BBSR-2, Dhenkanal and Paradeep Circle. Rest of the budget to be utilized for extension of AMC contract for software development and data sustenance.

4.5.6 Civil

Several activities have been planned to improve the current conditions of DT Plinth, 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.

TPCODL is currently having storage spaces available at 3 locations – Choudwar, Jalna and Bhubaneswar. These stores are not having proper infrastructure for sorting purpose for which racking system is proposed and also lift arrangement for material movement is required. Also civil infrastructure as per statutory requirements is also not available currently, which is being

proposed to be covered under this year's CAPEX of FY 22-23. For this purpose, floor concreting is proposed for Shed-7 and Shed-8.

At present TPCODL is imparting training to employees from rented premises. There is an urgent requirement to develop such infrastructure for conducting numerous training and seminars there by eliminating recurring expenditure. Development of auditorium type 100 seating capacity Training center including HVAC, LAN, washroom facilities, Projectors, Screens and other electronics accessories. Along with Area development and beautification with horticulture and gardening and parking space

In CAPEX FY 21-22, Rs 12.8 Crs have been approved by the Hon'ble Commission for Transformer repair workshop renovation, Constructing of +1 structure, Section Office, Platforms at Stores, buying of furniture. In CAPEX FY 22-23, TPCODL is proposing for a budget of Rs 13.49 Crs for the activities as listed below:

Table 66 : Capital Cost for Civil Infrastructure

Sl No.	Activity	Budget
1	Furniture	0.75
2	Section Offices - 4.5Lac*100 Nos	4
3	Rehab of Control rooms - 10Lac*15 Nos	1.25
4	Switchyard Fencing (chain link) - 4000Rs/m * 4KM	1.00
5	Compound Wall	1.00
6	Racking System, multiple floor, 2 no.s lift	1.5
7	Pakka floor and cover shed for transformer oil storage shed (as per statutory requirement)	1.00
8	Concreting of floor- Choudwar Store- Shed 7 and 8	0.99
9	Training Centre	2.000
	Total of Civil	**13.49**

4.5.7 Transformer Repair Workshop

Several activities have 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. In CAPEX FY 2021-22, a

budget of Rs 1.73 Crs has been approved and this year we are proposing for a budget of Rs 1 Cr for transformer repair workshop. This year we will be focusing on setting up of oil testing lab and transformer winding remaking infrastructures for the workshop.

4.5.8 Ready to Use Office Assets

New offices are coming up in various locations under TPCODL licensed area. Also section offices which have only one floor, construction of +2 floors are being proposed under CAPEX. And also new section offices are proposed to be constructed under CAPEX

With increasing number of office locations, the requirement of furniture, fixtures and other administrative assets also increases. Thus, an amount of Rs 1.5 Crs is proposed for administrative expenditure for the financial year 2022-2023.

Table 67 : Status of Project Progress as on 31.01.2022 against Capex approved for FY-2020-21

Sr No	Major Category	Activities	OERC Approved Capex	As on 31.03.2021		In FY 2021-22 (till Jan 2022)		Total As on 31st Jan 2022	
				Actual Capex	Capitalisation	Actual Capex	Capitalisation	Actual Capex	Actual Capitalisation
1	Statutory and Safety	33KV Network refurbishment to ensure Horizontal/Vertical Clearance	4.6	2.72	2.50	2.97	2.25	5.69	4.75
		PPEs, FFEs, Safety & Testing Equipment	9.48	4.22	2.44	2.80	0.00	7.02	2.44
		DSS Refurbishment for safety of Employees,public & Animals	47.34	9.73	4.55	17.61	15.88	27.34	20.43
		Establishment of Meter Testing Lab	6.78	0.08	0.00	4.31	4.15	4.38	4.15
		Sub Total (1)	**68.17**	**16.75**	**9.49**	**27.69**	**22.28**	**44.44**	**31.78**
2	Loss Reduction	Meter replacement against Burnt/Faulty & Mechanical/No Meter	13.65	5.61	2.81	0.00	0.00	5.61	2.81
		Installation of DT Meters	15.36	0.00	0.00	0.00	0.00	0.00	0.00
		Solution fo Meter Reading and Spot Billing	3.000	0.00	0.00	0.00	0.00	0.00	0.00
		Optimizing the length of 11KV Feeders (to reduce technical loss)	7.62	4.78	3.04	3.55	3.39	8.33	6.43
		Sub Total (2)	**39.63**	**10.39**	**5.85**	**3.55**	**3.39**	**13.94**	**9.24**
3	Reliability	110 Nos. GSS refurbishment for SCADA operationalization	26.43	6.50	5.50	7.66	4.24	14.17	9.73
		Installation of Auto reclosure / Sectionaliser,FPI & RMU	23.88	5.99	4.45	8.87	9.48	14.86	13.93
		Installation of LV protection at DSS	6.73	0.88	0.15	5.00	5.15	5.88	5.30
		Replacement of Battery and Battery charger	2.26	0.61	0.09	1.57	1.98	2.18	2.07
		Installation of 11 KV AB and 33 KV switches for imroving Reliability	13.18	3.88	2.64	2.09	2.08	5.97	4.72
		Sub Total (3)	**72.48**	**17.85**	**13**	**25.19**	**22.93**	**43.05**	**35.76**
4	Load Growth	Meter installation for all new connection	0	0.00	0.00	0.00	0.00	0.00	0.00
		Network augmentation / addition to meet load growth	9	0.16	0.00	1.24	0.00	1.40	0.00
		Sub Total (4)	**9.00**	**0.16**	**0.00**	**1.24**	**0.00**	**1.40**	**0.00**
5	Infrastructure	Infrastructure for Customer Care , Call Center , Payment Center and Section Offices	6.36	0.15	0.00	0.65	0.54	0.80	0.54
		ERP, MBC, CIS and BI Systems S/w & H/w and User End Devices Laptop,Desktop,Printers	67.22	31.26	31.24	19.29	19.15	50.55	50.39
		Implementation of GIS 1st phase	2	0.89	0.89	0.83	0.78	1.71	1.67
		Security system in Central Store	2.92	0.60	0.61	0.24	0.17	0.84	0.78
		Civil Upgradation	7.95	5.18	4.20	3.69	4.66	8.87	8.86
		Ready to use assets for offices	4.9	2.07	1.44	2.41	2.72	4.48	4.17
		Sub Total (5)	**91.35**	**40.16**	**38.38**	**27.11**	**28.04**	**67.27**	**66.41**
		Total	**280.63**	**85**	**67**	**84.78**	**76.64**	**170.09**	**143.2**

6 Annexure 5 : Capex approved for FY 2021-22 (Status)

Table 68 : Status of Project Progress as on 31.01.2022 against Capex approved for FY-2020-22

Sr No	Major Category	Activities	OERC Approved Capex	In FY 2021-22 (till Jan 2022) Actual Capex	In FY 2021-22 (till Jan 2022) Capitalisation
1	Statutory and Safety	Equipment enhancing Safe Work Environment	4.76	0.56	0.00
		Installation / Construction of Plinth fencing or Boundary wall of DSS or GSS. Area development wherever substation	4.33	0.20	0.20
		Development of Meter Testing Lab and its Accreditation	2.44	0.00	0.00
		DSS refurbishment	6.06	0.66	0.12
		Sub Total (1)	**17.59**	**1.42**	**0.32**
2	Loss Reduction	Old Electromechanical Meter and Defective Meters replacement	3.77	0.73	0.00
		Smart Meter Implementation	47.59	0.00	0.00
		Infrastructure for spot billing & spot collection.	3.07	0.00	0.00
		Equipment like Accu Check, CMRI, Digital Camera	0.80	0.40	0.00
		LT O/H Bare to LT AB Cable conversion	12.12	6.60	2.32
		Sub Total (2)	**67.35**	**7.73**	**2.32**
3	Reliability	SCADA implementation	21.64	0.00	0.00
		GSAS Implementation	21.71	0.00	0.00
		33KV and 11KV Sick Equipment Replacement	13.40	4.99	0.00
		33KV System Improvement schemes - Feeders and Power Evacuation from OPTCL	25.97	10.11	6.75
		33KV System Improvement schemes - Equipment like 33KV RMU, Isolators etc	8.37	2.07	0.00
		11KV System Improvement schemes - Feeders and Equipment like RMU, ACB, MCCB, AB Switches, Mobile DT ,Earthing etc	18.99	5.33	2.49
		Distribution transformer augmentation	4.33	0.41	0.00
		Sub Total (3)	**114.42**	**22.92**	**9.24**
4	Load Growth	Meter Installation for all new connection	0.00	0.00	0.00
		Network Extension to release New Connection	17.32	5.62	4.60
		Addition / Augmentation of Power Transformers	13.20	0.02	0.00
		Sub Total (4)	**30.52**	**5.64**	**4.60**
5	Infrastructure	Infrastructure for Customer Care , Call Centre , Payment Centre and Section Offices	4.33	0.00	0.00
		IT & Technology for process efficiency & enhanced productivity.	21.64	0.28	0.27
		Implementation of GIS Roadmap	17.32	0.58	0.00
		Augmentation of Communication Network in TPCODL Area	4.73	0.00	0.00
		Transformer Repairing Workshop	1.73	0.00	0.00
		Central Store development	4.33	0.27	0.00
		Civil Upgradation	12.81	0.38	0.00
		Ready to Use assets for Offices	1.95	0.04	0.00
		Sub Total (5)	**68.84**	**1.55**	**0.27**
		Total	**298.72**	**39.25**	**16.75**

7 Annexure 6- BOQ of Scheme improving Bhubaneshwar City Reliability

8 Annexure 7- BOQ of Scheme for addressing Low Voltage

9 Annexure 8- BOQ for Yearly Schemes