



DETAILED PROJECT REPORT FOR

REPLACEMENT OF 22 KV BUS SECTIONS I & III
REPLACEMENT OF 33 KV BUS SECTIONS I & II
AT CARNAC RECEIVING STATION

TRANSMISSION SCHEME

JUNE 2011

TATA POWER

The Tata Power Company Limited

Engineering Department 6th Floor 'B' Block Corporate Center 34 Sant Tukaram Road

Carnac Bunder Mumbai 400 009 Fax 91 22 6717 1650

Registered Office Bombay House 24 Homi Mody Street Mumbai 400 001

THE TATA POWER COMPANY LTD.

**DETAILED PROJECT REPORT
FOR
REPLACEMENT OF 22kV BUS SECTIONS I & III
REPLACEMENT OF 33 kV BUS SECTIONS I & II
AT CARNAC REC STATION**

DOCUMENT NO. TCE-5648A-EL-737-062



**TATA Consulting Engineers Limited
4th Floor, Tower 'A', 247 Park,
LBS Marg, Vikhroli (W),
MUMBAI - 400 083.**

JUNE-2011

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1.0 PURPOSE OF THE PROJECT

Carnac receiving station has 2 nos. of 22kV bus sections as 22kV Bus section – I & III & 4 nos. of 33kV bus sections as 33kV Bus section – I,II,III & IV.

The 22kV Bus sections I, III & 33kV bus sections III & IV are located in Station block-A building on the first floor & 33kV Bus sections I & II are located in Station block-B building. The SLD attached here in Exhibit – 1.1 shows the existing arrangement of 22kV & 33kV bus sections.

This DPR includes following two projects.

- a) There are various 22kV & 33kV feeders in Carnac receiving station. These switchgears are in operation almost from last 50 years. The availability of spare parts, performance of equipments is major concern. To avoid this, replacement of existing 22kV bus sections I & III is proposed.
- b) Replacement of 33kV GIS bus sections I & II is proposed as the existing AIS switchgears are old also continuous load growth of 5-6% is expected on 33kV feeders in upcoming years, thereby needing provision of additional 33kV outlets

They are covered in two sections.

Section I covers dismantling & replacement of 22kV old AIS Bus sections I & III by new 33kV GIS BS -I & III & proposed to be operated at 22kV. Henceforth, it is described as 22kV GIS BS I & III.

Section-II covers dismantling of 33kV AIS Bus sections I and II in Carnac station block- B building & shifting of respective loads to new 33kV GIS Bus section I & II, to be located in the Carnac station block-A (in the space vacated by 22kV bus sections- I & III). The existing 33kV AIS Bus sections III & IV will remain in Block A only.

With this arrangement, All the 22kV GIS, 33kV AIS switchgear & GIS shall be located in single building (Block 'A') . The entire arrangement is shown in Exhibit – 2.2

2.0 BACKGROUND

Carnac R/S is presently supplying power at 22 kV & 33 kV voltage level to two distribution licensees BEST and Tata Power (D).

There are two nos. of 22 kV Bus Sections and four nos. of 33 kV bus sections at this station catering the existing load requirements of these two DISCOMs. There is continuous load growth in the range of 5 to 6% in areas fed by this station. BEST, Tata Power (D) have approached Tata Power (T) to extend additional outlets on 33 kV side to meet their increasing load demand.

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3.0 SUMMARY OF YEAR WISE EXPENDITURE & TARIFF IMPACT OF TWO SCHEMES TOGETHER

3.1 YEAR WISE TOTAL EXPENDITURE OF TWO SCHEMES IN Rs Lakhs

Financial Year	Replacement of 22kV Bus I/III	Replacement of 33kV Bus I/II	Year wise Total expenditure
2011-12	740	-	740
2012-13	146	1252	1398
2013-14	-	223	223
Total Expenditure (Year wise)	886	1475	2361

3.2 YEAR WISE TARIFF IMPACT OF TWO SCHEMES IN PAISE/Kwh

Financial Year	2013-14	2014-15	2015-16	2016-17	2017-18
22kV bus	0.01	0.01	0.01	0.01	0.01
33kV bus	-	0.02	0.02	0.02	0.02
Total Tariff Impact	0.01	0.03	0.03	0.03	0.03

SECTION I (Replacement of 22kV Bus section I & III by 33kV GIS-I & III)

1.0 Purpose and Necessity

The present Brown Boveri make 22 kV Switchgear is old (installed in 1961) and has an inventory value of Rs 25 lakhs. There are no spares available for the air blast circuit breakers. Also, additional space is required to accommodate additional of outlets at 33 kV. It is proposed to retire present 22 kV AIS Switchgear & replace with 33 kV GIS Switchgear operated at 22 kV. This will create space for new addition of 33kV GIS bus and outlets for transferring existing BEST 22kV feeders to 33kV bus, Without constructing any new building & increasing the expenditure,

1.1.1 Scope of the Present Report

Existing 22kV AIS Bus section III has total 11 nos of feeders (7 nos. O/G, 2 nos Cap bank, 1 no each incomer, bussection & Stn Trf) and loading of 26MW and Bus section I has total 6 No of feeders (5 nos O/G & 1 no incomer) and loading of 16 MW.

This section of DPR covers the replacement of 2 nos of 22 kV bus sections i.e. AIS Bus section I & III by 33 kV GIS (operated at 22 kV). The GIS shall comprise 6 nos feeder outlets, one breaker each for Capacitor bank and Incomer, on each bus section, and one bus section breaker.

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1.2 Impact of not carrying out the Project.

The existing 22 kV switchgear is 50 Years old and has maintenance problems. Non availability of spares is a major concern. Non availability of spare breakers & spares, in case of failure of any breaker of this switchgear, will cause interruption of supply to customers.

Also if the existing 22 kV AIS is not replaced by GIS, there will not be space available for any additional outlets to BEST & TPC (D) on 33 kV.

1.3 Implementation Strategy Studied

The following strategy is considered to meet the requirements:

1.4.1 Replacement of 22kV switchgear by 33kV GIS (operated at 22 kV)

1.4.1.1 The vacant space is not available in existing room in Carnac station block-A for installation of GIS. But it can be made available by shifting of a few 22kV AIS bus section feeders. One new 22kV GIS with 2 nos. of Bus sections shall be installed in vacant space in existing 22/33kV Switchgear Room. Exhibit- 1.2 shows a typical SLD of the proposed 22kV GIS. Vacant space for 22kV GIS BS I & III can be made available as explained in following steps.

The step by step procedure for replacing the entire 22kV AIS Switchgear BS I & III by 33kV GIS BS I & III (To be operated at 22kV) shall be as follows:

STEP 1:- Shifting of existing 22kV feeders on BS III available spare feeders on same bus section & making space for new 22kV GIS BS III.

- Relocate existing Naval Dockyard 2 to spare feeder 18.
- Relocate existing Wadi Bunder to Cap. Bank 2 bay (which is not used frequently).
- Relocate existing station transformer#2 & Naval Dockyard 1 to spare feeder 16 & 17.

STEP 2:- Dismantle existing 22 kV breakers on BS III starting from south side i.e breakers between Naval Dockyard-1 & 2. Install a 22kV GIS BS III in this location.

STEP 3:- Tie breaker of 22kV AIS BS I & III shall be closed and then TR#4 incomer shall be shifted to 22kV GIS BS III incomer for charging of 22kV GIS BS III. Stand by supply to 22kV GIS BS III shall be made available by making spare feeder 12 of AIS BS I as tie breaker & connecting to one of outgoing breaker of new 22kV GIS BS III.

STEP 4:- Shift following feeders back on 22kV GIS BS III i.e. Naval dockyard 1 & 2, Wadi Bunder & station transformer # 2.

STEP 5:- The space for new 22kV GIS BS I to be made by shifting of following feeders of 22kV AIS BS III

- Marine drive-3 feeder can be shifted to 22kV GIS BS III
- Shift Cap-3 feeder to Capacitor feeder of 22kV GIS BS III.
- Shift Mazgaon-2 feeder to spare feeder 18 of 22kV AIS bus section-III.

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STEP 6:- Dismantle the breakers mentioned in step 5 of 22kV AIS bus section- III i.e. Marine drive-3, Mazgaon-2, & spare feeders available in between them. This will create space for 22kV GIS BS I which will be located as shown in Exhibit 1.4.

STEP 7:- Disconnect tie breakers between 22kV GIS BS III and BS I and shift tie to 22kV GIS BS I for standby incomer from AIS BS I and close the bus section between 22kV GIS BS III & 22kV GIS BS I and 22kV GIS BS I can be charged by bus coupler breaker between 22kV GIS BS III & 22kV GIS BS I and also close tie breaker between 22kV GIS BS I and BS I for standby incomer.

STEP 8:- After charging 22kV GIS BS I, shift remaining feeders of 22kV bus section III & I on 22kV GIS BS I.i.e. BPT-2 & all other feeders (except spare feeder-12 of 22kV BS I used as tie breaker) of 22kV bus section I.

STEP 9:- Shift incomer TRF#3 of BS I to 22kV GIS BS I incomer section and open the buscoupler breaker between 22kV GIS BS III & 22kV GIS BS I and open tie breaker between 22kV GIS BS I (one of outgoing breaker) and BS I (spare feeder 12).

STEP 10:- Further dismantle the 22kV AIS BS I and remaining breakers of AIS BS III, and the entire 22kV Switchgear will be replaced by 2 numbers 22kV GIS BS III & 22kV GIS BS I Exhibit-1.4 shows the proposed 22/33kV Switchgear layout after replacement of entire 22kV Switchgear by 22kV GIS BS III & 22kV GIS BS I. 22kV GIS shall be fed through the existing 22kV incoming cables.

2. TECHNICAL DETAILS OF IMPLEMENTATION STRATEGY

2.1 Scope of Work

Replacement of existing 22kV AIS BS I & III by 22kV GIS BS III & I and shifting all loads to 22kV GIS BS III & I.

2.2 Technical requirements

2.2.1: 33 kV GIS Switchgear (To be operated at 22kV)

Proposed 33kV GIS switchgear will be single bus type with BCPUs for control and protection.

Based on the number of incoming and outgoing feeders, it is proposed to have 9 bays for 22kV GIS BS III (including bus section breakeer) and 8 bays for 22kV GIS BS I in the 33kV GIS as follows:

- Incoming Bay – 1 no.

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- Outgoing Bays – 6 nos.
- Capacitor bank - 1 no.

2 nos. of 22kV PT's to be provided per bus section.

The proposed 33 kV GIS will be located in the 22/33kV Switchgear room at Carnac block-A.

The basic technical requirements of 33kV GIS will be as follows:

Fault Level: 31.5 kA, 3 sec.

Highest System Voltage: 36 kV (rms)

Basic Impulse Level: Impulse withstand: 170 kV (peak)

One minute power frequency voltage: 70 kV (rms)

Continuous current rating of Busbar: 2500A

Current rating of Incomer & bussection : 2500A.

Current rating of outgoing feeder breakers: 1250A

The above is in line with standard ratings of 33kV GIS installed in Tata Power system at other substations.

2.2.2 33 kV Power Cables

The 33 kV cables of extra length will be required for extension of incomer supply from Transformer#4 to new 22kV GIS BS III & for tie cable between 22kV AIS bus section-I & 22kV GIS BS I.

Rated voltage	Nominal 33 kV, Max. 57 kV
Insulation	XLPE
Conductor size	630 sq.mm
No. of cores	Single core
Conductor material	Plain Copper
Sheathing	PVC outer sheath
Current Rating	660 A
Overall derating factor	0.75 (conservative)
Current rating after derating	495 A
Short circuit capacity required	90 kA, 1 sec required
Approx. overall diameter of	65.5 cable (mm)
No. of runs required for incomer And tie cable	4 Runs/Phase

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2.2.3 Protection, Control and Monitoring

For 22 kV system, only BCUs with over current protection are proposed to be provided and no backup control panels are envisaged.

In addition to the provision for local control from 22kV GIS Bay itself, remote control of the breakers from SCADA is envisaged.

Proposed Scheme of integration to SCADA:

It is proposed to commission the BCUs and BCPUs along with Gateways at R/S and integrate these gateways to the following systems:

- a. Unified SCADA System being commissioned at CCR Dharavi.
 - b. Nodal SCADA System
 - c. AREVA SCADA System at Load Control Centre Trombay.
1. BCPUs for 22kV GIS bays (17 nos.) will be mounted on LV compartment of GIS (supplied by GIS Vendor). These BCPUs shall communicate on IEC61850 to redundant Gateways installed in separate panel for all 22kV Bays. These redundant gateways will also communicate to SCADA masters at Dharavi (Unified SCADA System), Carnac R/S SCADA (Nodal System) and LCC Trombay (AREVA System) on IEC104.
 2. The systems to be procured and services required for the above project are as follows:

From the GIS Vendor:

- i. BCPUs for 22kV Bays
- ii. Energy Meters for all 22 kV bays
- iii. Gateways with Ethernet switches
- iv. Auxiliary relays for Digital outputs
- v. Networking equipment and accessories
- vi. Services

2.2.4 Auxiliaries and Other Facilities

415 V AC & DC supply for the 22 kV GIS will be taken from the existing distribution board. Additional sub-distribution boards will be proposed during detailed engineering, if required.

Earthing system is to be provided in line with standard practices.

Communication facilities in line with the standard practice followed in the other main receiving stations shall be provided in the proposed building.

2.3 Location and Space Requirement

It is proposed that the new 22kV GIS BS I & III shall be located in the existing

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22/33kV Switchgear room in Carnac block-A. Initially, the 22kV GIS BS III will be located in the vacant space (8.2m X 2.3m) made available by dismantling of existing 22kV AIS BS III on the first floor. This space is sufficient only for installation of one bus section having 6 nos. of Outgoing feeders, one breaker for Capacitor Bank, one for Incomer and one for bussection. Hence, 22kV GIS BS I shall be installed in vacant space (7.7m X 2.3m) only after the dismantling existing 22kV BS III in phases. It is shown in exhibit 2.2.

2.4 Time period involved

The project schedule shown in Appendix-1.2 is drawn based on the delivery data furnished by vendors and available with TCE for similar other projects.

18 months time period will be required for replacement of 22kV AIS BS I & III by 22kV GIS BS I & III. During this period, complete project will be executed right from designing stage to commissioning stage.

The above schedule assumes that the procurement activity for the major equipment such as 33kV GIS & 33kV Cables will be based on the standard design philosophy adopted by Tata Power.

2.5 Statutory Approvals Required

Electrical Inspector's approval will be obtained for the electrical layout.

3. Financial Details

3.1 Total Estimated Expenditure

Cost of major items comprising of 33kV GIS, SCADA and protection system up gradation are mainly from budgetary estimates furnished by vendors and recent orders will be placed by them for similar project.

Cost of 33kV GIS is based on the cost incurred on similar project, in the recent past. Sales tax, excise duties and octroi duties are incurred on indigenous equipment.

An annual price escalation and physical contingency together is considered as 2.0% to cover possible differences between actual and estimated quantities, commission of minor items of work, possible minor changes at project execution stage and unforeseen items.

The total cost of the project inclusive of 33kV GIS, etc. is estimated as Rs. 886 lakhs.

3.2 Cost Break-up

Detailed total cost estimate of the project is furnished in Appendix 1.3. The basis for the cost estimate is furnished in Appendix-1.4.

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3.3 Source of Funding

It is proposed to fund the project either from internal accruals or from reputed leading institutions.

3.4 Phasing of Expenditure

Based on the delivery schedule for the various items and the project schedule, the estimate of the phasing of the expenditure on yearly basis is drawn up and is as enclosed in Appendix – 1.5.3.

3.5 Cost Benefit Analysis (CBA)/ Tariff Impact

A detailed CBA with assumptions is indicated in Appendix – 1.5.4.

4.0 BENEFITS OF THE PROJECT

4.1 Tangible

The present 22 kV Switchgear is more than 50 yrs old (having an inventory value of Rs 25 lakhs) has maintenance problems due to lack of availability of spares. Space is required to accommodate additional outlets at 33 kV, without constructing any new building (increased expenditure) It is proposed to retire present 22 kV bus section I & III and replace with 22kV GIS BS III & I.

4.2 Benefit to the Customers

Customers will get more reliable and continuous supply, with reduced failure rate & maintenance requirement, due to usage of GIS.

4.3 Indirect Savings / Improvements

The existing 22kV switchgear shall be replaced by new 33kV GIS (To be operated at 22kV). This shall enhance the reliability of the power supply as well as reduce the maintenance cost for the switchgear. Further, since GIS is compact as compared to conventional switchgear, hence reducing the space requirement and provisions for additional no. of outlets can be made at a higher voltage level without constructing new building. It is also proposed to standardize the bus sections. With the new GIS in service there will be increased safety & reduced maintenance from the O&M point of view.

5.0 RECOMMENDATION AND CONCLUSION

Since the 22kV bus sections breakers have out lived their life, it is recommended to replace them by new 33kV GIS (Operated on 22kV) for reliability.

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Appendix –1.1

(Estimated Project Schedule for replacement of 22kV Bus sections)

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APPENDIX-1.1

Estimated Project Schedule for Proposed Replacement of 22kV swgr. by 33kV GIS at Carnac R/S

Monthwise Activities

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DESIGN ENGINEERING																		
PERMISSION FROM CONCERNED AUTHORITIES																		

PREPARATION OF TENDER DOCUMENTS

RELOCATION OF EXISTING FEEDERS & THEIR CIVIL WORK																		
22kV GIS BS I & III (33kV GIS OPERATED AT 22kV)																		
OTHER FACILITY LIKE AUX. MISCELLANEOUS ITEMS																		
CABLES, CABLE ACCESSORIES																		

PLACEMENT OF ORDER

CIVIL WORK																		
22kV GIS BS I & III (33kV GIS Operated at 22kV)																		
CABLES																		
CABLE ACCESSORIES																		
OTHER FACILITY LIKE AUXILIARY, MISCELLANEOUS ITEMS																		

VENDOR DRAWING REVIEW

22kV GIS BS I & III (33kV GIS Operated at 22kV) OTHER ELECTRICAL EQUIPMENT																		
CABLES																		
CABLE ACCESSORIES																		
MISCELLANEOUS ITEMS																		

APPENDIX-1.1

Estimated Project Schedule for Proposed Replacement of 22kV swgr. by 33kV GIS at Carnac R/S

Monthwise Activities

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SITE ACTIVITY																		
CIVIL WORK FOR RELOADED FEEDERS & PROPOSED GIS																		
SUPPLY INSTALLATION, TESTING AND COMMISSIONING OF 22kV GIS BS I & III AND OTHER ELECT. EQUIP. IN PHASES																		
SUPPLY AND INSTALLATION OF AUXILIARY & MISCELLANEOUS ITEMS																		
SUPPLY OF CABLE ACCESSORIES, SHIFTING OF FEEDERS AND TERMINATING ON GIS																		

NOTE:

1. Total duration of implementation of the scope of this DPR is 18 months starting from design activity upto end of commissioning of entire system.

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Appendix – 1.2

Cost Estimates for Proposed Project (Replacement of 2 nos. Of 22kV Bus sections)

Sr. No.	Description	Qty	Unit	Unit Price (Lakhs)	Item Price (Lakhs)	Remarks
1	Civil works for 33kV GIS Installation	1	LS	28	28	
2	Procurement of 33kV GIS complete with CTs, Dummy Panels disconnections, BCU/ BCPU equipment	2 (17 bays)	set	272	544	For details of no. of bays ref clause no. 2.2.1 of section I
3	33kV, 1 C X 630 Sq. mm Cu-XLPE Cables	2000	m	0.04	80	
4	Installation of 33kV cable terminations for bays	20	Set	0.3	6	
5	Aux. System (earthing, cable trays, etc) - lump sum	1	LS	24	24	
6	LV Power & control cables	1	LS	28	28	
7	Services for SCADA integration Trombay, Dharavi, Carnac	1	LS	21	21	
8	Installation, erection, testing & commissioning of all equipments	1	LS	36	36	
9	Consultancy Services	1	LS	4	4	
10	Staff cost (2% of material cost)		LS		36	
11	Provision for contingencies @ 2%				16	
12	IDC				63	
13	Total Project Cost				886	

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Appendix 1.3 **Basis of Cost estimate**

The details and the basis of cost estimates of the major items included in the cost estimates of the proposed project are as follows:

- **33 kV GIS**
 - Required number of bays equipment with single bus bar arrangement including maintenance tools and supervision of erection and commissioning.
 - The cost estimate of 32 Lakh per bay is considered based on recent 33 kV GIS procured for ongoing projects
- **SCADA : computer based SCADA system**
 - The cost estimate is based on executed projects.
- **Control and Protection Panels**
 - Cable incomer feeders (Includes distance protection, backup directional over current and earth fault protection with energy meter and all other auxiliary relays and devices)
 - Bus bar protection, sequence of events recorder and annunciation panels
 - The cost estimate is based on recent GIS projects of Tata Power.
- **Power cables and accessories**
 - 33 kV, 1C x 630 sq.mm copper XLPE insulated single core cables for incomer feeders
 - Pre mounted straight joints for joining 33 kV cables
 - Cost estimation is based on recent projects of Tata Power
- **Civil Works**
 - Based on the quantum of work and past experience in similar recently executed projects by Tata Power.
- **Auxiliary System**
 - The cost estimate is based on past experience.
- **Miscellaneous costs and provision for contingencies**
 - Physical contingency has been provided to cover possible differences between actual and estimated quantities, omission of minor items of work, possible minor changes at project execution stage and unforeseen items.
- **Preliminary works, investigation and design engineering**
 - The costs are considered typically based on recently executed projects.

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Appendix – 1.4

**(Estimated Expenditure during Project Execution)
(By Tata Power)**

Year	Estimated Cost in Rs. Lakhs
FY-12	740
FY-13	146
Total	886

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Appendix – 1.5

(Financial Calculations)

ISSUE R1

APPENDIX:1.5.1

Assumption -Technical , Commercial and Financial:

Transmission

Replacement of 22 KV Bus Sections I & III at Carnac

A	Technical & Commercial		
1	<u>O & M Cost</u>		
	O & M Cost as Percent of Completed Capital Cost	4.0%	Percent
	Escalation of O & M Cost per year	2.5%	Percent
2	Average Variable Cost-Thermal	3.71	Rs. per Unit
3	<u>Project Duration</u>		
	Project Starts	FY12	
	Estimated Construction Period	18	Months
	Operation Commences	FY13	
B	Financial Assumptions		
1	<u>Structure</u>		
	Loan/Debt	70.0%	Percent
	Equity	30.0%	Percent
	<u>Income Tax</u>		
2	Rate of Tax- Corporate Tax	33.66%	Percent
	<u>Debt</u>		
3	Rate of Interest on Debt/Loan	11.5%	Percent
	Loan repayment period	10	Years
4	<u>Depreciation</u>		
	Depreciation as per Electricity Act/Tariff	3.60%	%
	Depreciation as per Income Tax Act	15.00%	%
5	<u>Interest During Construction</u>		
	Whether Capitalized or Written Off	Capitalized	(Old Written iff)
6	<u>Staff Costs</u>		
	Average CTC of Technician/Year	5.5	Rs.Lakhs
	Average CTC of Engineer/Year	8	Rs.Lakhs
	Escalation Rate: Salary (%)	14%	Rs.Lakhs
	Saving due to Higher Transmission availability	66.67%	%
	Manpower Saving: Technician	66.67%	%
	Saving in Operation Expenses (AMC etc.)	66.67%	%
	State Transmission System as per Intra state Order (ARR)		
	Total Transmission System Cost	265,373	Rs Lakhs
	Escalation in Transmission system cost	2.5%	% p.a
	Reasonable Return on Equity	14%	Percent
	Total Sales -MSEDCL	70,480	MUs
	Total Sales -REL	8,424	MUs
	Total Sales -BEST	4,390	MUs
	Total Sales -Tata Power-D	3,990	MUs
	Total Sales of all Distribution Utilities	87,284	MUs
	Growth in electricity sales	5.0%	%
	Transmission losses	4.85	%
	<u>Additional Average Peak Transission Capacity</u>		
	Average Peak Transmission Capacity added due to this project	Not Applicable	MVA

APPENDIX:1.5.2

BRIEF PROJECT COST ESTIMATE		
Replacement of 22 KV Bus Sections I & III at Carnac		
		Rs Lakhs
1	Civil Works for 33 KV Bus	28
2	Procurement of GIS complete with CTs, Dummy panels disconnections, BCU/BCPU equipment	544
3	33 KV 1C*630 Sq mmCopper XLPE cables for shifting transformers to new bus	80
4	Installation of 33 KV cable terminations for bays	6
5	Aux sysytem(Earthing , cable trays etc) Lump sum	24
6	LV Power & control cables	28
7	Services for SCADA Intergrationat LDD ,Dharavi, Carnac	21
7	Installation errection , testing & commissioning chargesfor all equipment	36
8	Consultancy services	4
9	Staff cost @ 5% of material cost	36
10	Provision for contingency @ 2 %	16
17	IDC -Interest During Construction	63
	TOTAL PROJECT COST (incl. IDC)	886

APPENDIX:1.5.3

A. PHASING OF EXPENDITURE:

Replacement of 22 KV Bus Sections I & III at Carnac

		<div> <div>1</div> <div>3</div> <div>7</div> <div>11</div> <div>14</div> <div>15</div> <div>18</div> </div>								
		FY12	FY13	FY12 Oct	FY12 Dec	FY13 Apr	FY13 Aug	FY13 Nov	FY13 Dec	FY13 Mar
				1	1	1	1	1	1	1
Phasing of Expenditure	Total Rs. Lakhs									
Civil Works for 33 KV Bus	28	28.00		28						
Procurement of GIS complete with CTs, Dummy panels disconnections, BCU/BCPU equipment	544	544.00			544					
33 KV 1C*630 Sq mmCopper XLPE cables for shifting transformers to new bus	80	80.00			80					
Installation of 33 KV cable terminations for bays	6	6.00			6					
Aux sysytem(Earthing , cable trays etc) Lump sum	24	24.00			24					
LV Power & control cables	28	28.00			28					
Services for SCADA Intergrationat LDD ,Dharavi, Carnac	21	2.13	19.13		2	4	4		4	6
Installation errection , testing & commissioning chargesfor all equipment	36	3.60	32.40		4	7	7		7	11
Consultancy services	4	0.40	3.60		0.4	1	1		1	1
Staff cost @ 5% of material cost	36	3.55	31.95		4	7	7		7	11
Provision for contingency @ 2 %	16		16.14							16
IDC -Interest During Construction	63									
Total Project Cost	886	720	103	28	692	19	19		19	45
Capitalization Phasing with IDC	886		886					821		65
Cumulative Capitalization with IDC	886		886					821	821	886

B. IDC Calculation :

Expenditure

Expenditure-Phasing	823	720	103	28.00	691.68	19.35	19.35		19.35	45.16
Expenditure-IDC	63	20	43	0.19	4.86	5.13	5.40	5.51	0.13	0.44
Expenditure-Total with IDC	886	740	147	28.19	696.54	24.48	24.75	5.51	19.48	45.60
Cumulative Expenditure-Total with IDC	886	740	886	28.19	724.92	764.18	804.52	820.93	840.41	886.27
Disbursal of Indian Loan and Equity										
Cumulative Equity	30%	222	266	8.46	217.48	229.25	241.35	246.28	252.12	265.88
Equity	266	222	44	8.46	208.96	7.34	7.42	1.65	5.84	13.68
Loan	620	518	103	19.73	487.58	17.13	17.32	3.85	13.64	31.92
Cumulative Loans	70%	518	46	19.73	507.44	534.93	563.16	574.65	588.28	45.74
Capitalization during previous month									820.93	
Balance Cum Loan for IDC		518	46	19.73	507.44	534.93	563.16	574.65	13.64	45.74
<i>Interest During Construction -IDC</i>	63	20	43	0.19	4.86	5.13	5.40	5.51	0.13	0.44
<i>Cumulative IDC</i>	63	20	63	0.19	5.24	25.16	46.14	62.55	62.68	63.38

Replacement of 22 KV Bus Sections I & III at Carnac

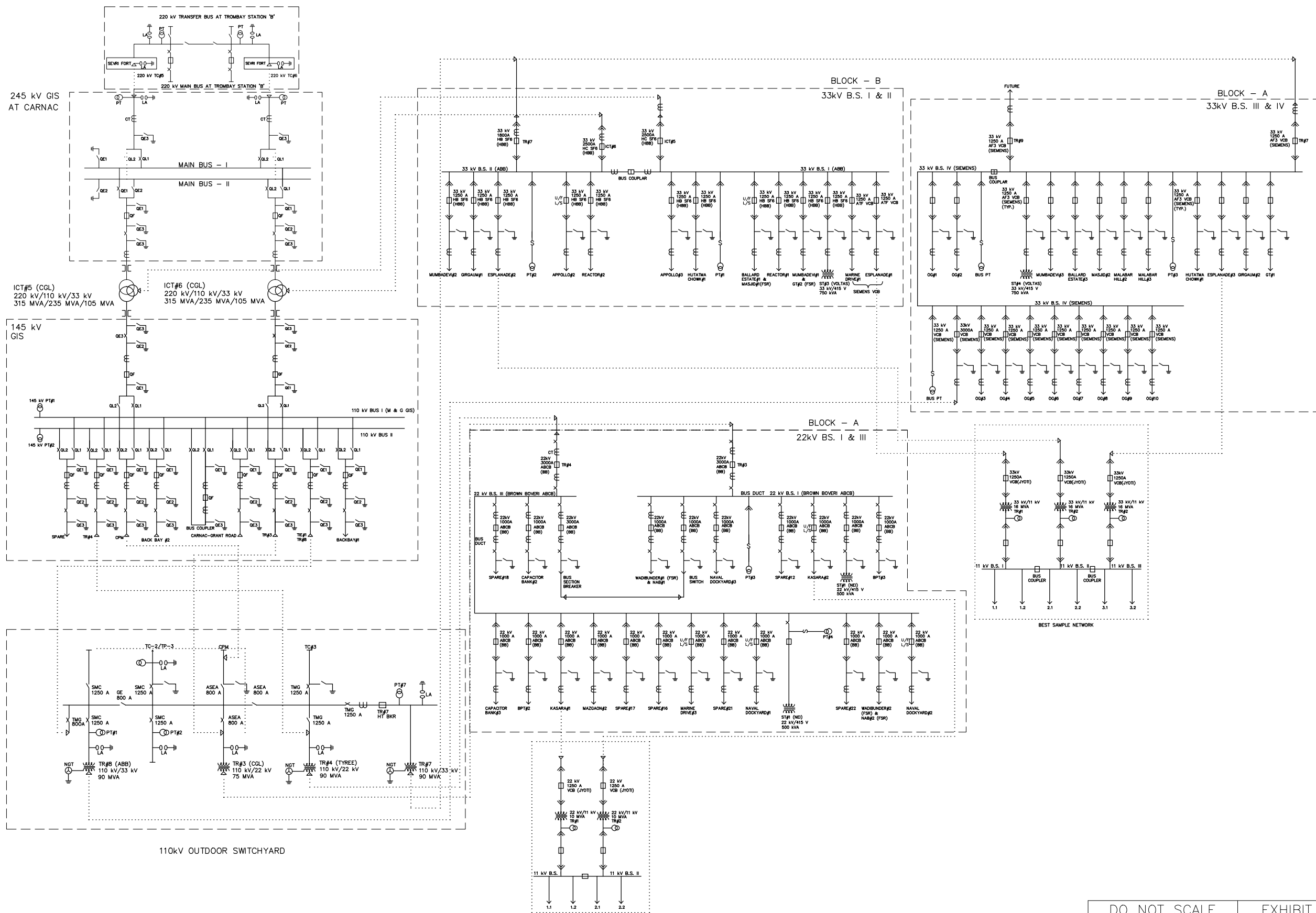
COST BENEFIT ANALYSIS/IMPACT ON TARIFF:

[illegible]

BACK UP CALCULATIONS:

Replacement of 22 KV Bus Sections I & III at Carnac

		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Year Ending		FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27
Project Capitalization	Rs Lakhs	0	886	0	0	0	0										
Project Capitalization -Cumulative	Rs Lakhs	0	886	886	886	886	886										
Costs Due to this project																	
O & M Expenditure																	
O & M Expenses	Rs Lakhs		0	35	37	38	40	41	43	45	47	49	50	52	55	57	59
Interest on borrowings after project completion																	
Opening Balance	Rs Lakhs		0	620	558	496	434	372	310	248	186	124	62	0	0	0	0
Repayment	Rs Lakhs		0	62	62	62	62	62	62	62	62	62	62	0	0	0	0
Closing Balance	Rs Lakhs		0	558	496	434	372	310	248	186	124	62	0	0	0	0	0
Interest on borrowings	Rs Lakhs		0	71	64	57	50	43	36	29	21	14	7	0	0	0	0
Interest During Construction	Rs Lakhs	20	43	0	0	0	0										
Tariff/Book Depreciation																	
Depc	Rs Lakhs		0	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Accum Depc	Rs Lakhs	0	0	32	64	96	128	160	191	223	255	287	319	287	319	351	383
Income Tax Depreciation																	
Opening WDV	Rs Lakhs	0	0	886	753	640	544	463	393	334	284	241	205	174	148	126	107
Depc	Rs Lakhs	0	0	133	113	96	82	69	59	50	43	36	31	26	22	19	16
Project Capitalization	Rs Lakhs	0	886	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Closing WDV	Rs Lakhs	0	886	753	640	544	463	393	334	284	241	205	174	148	126	107	91
Return on Equity	14%																
Additions to Gross Block -Capitalization	Rs Lakhs		0	886	0	0	0	0									
Removal from Gross Block	Rs Lakhs	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Block/Capex	Rs Lakhs	0	0	861	861	861	861	861	861	861	861	861	861	861	861	861	861
Equity Component	Rs Lakhs	0	0	258	258	258	258	258	258	258	258	258	258	258	258	258	258
Return on Equity	Rs Lakhs	0	0	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Incremental Income Tax																	
Return on Equity	Rs Lakhs	0	0	36	36	36	36	36	36	36	36	36	36	36	36	36	36
Add Book Depc	Rs Lakhs	0	0	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Less Tax Depc	Rs Lakhs	0	0	133	113	96	82	69	59	50	43	36	31	26	22	19	16
Tax @33.66%	Rs Lakhs	0	0	-33	-23	-14	-7	-1	5	9	13	16	19	21	23	25	26



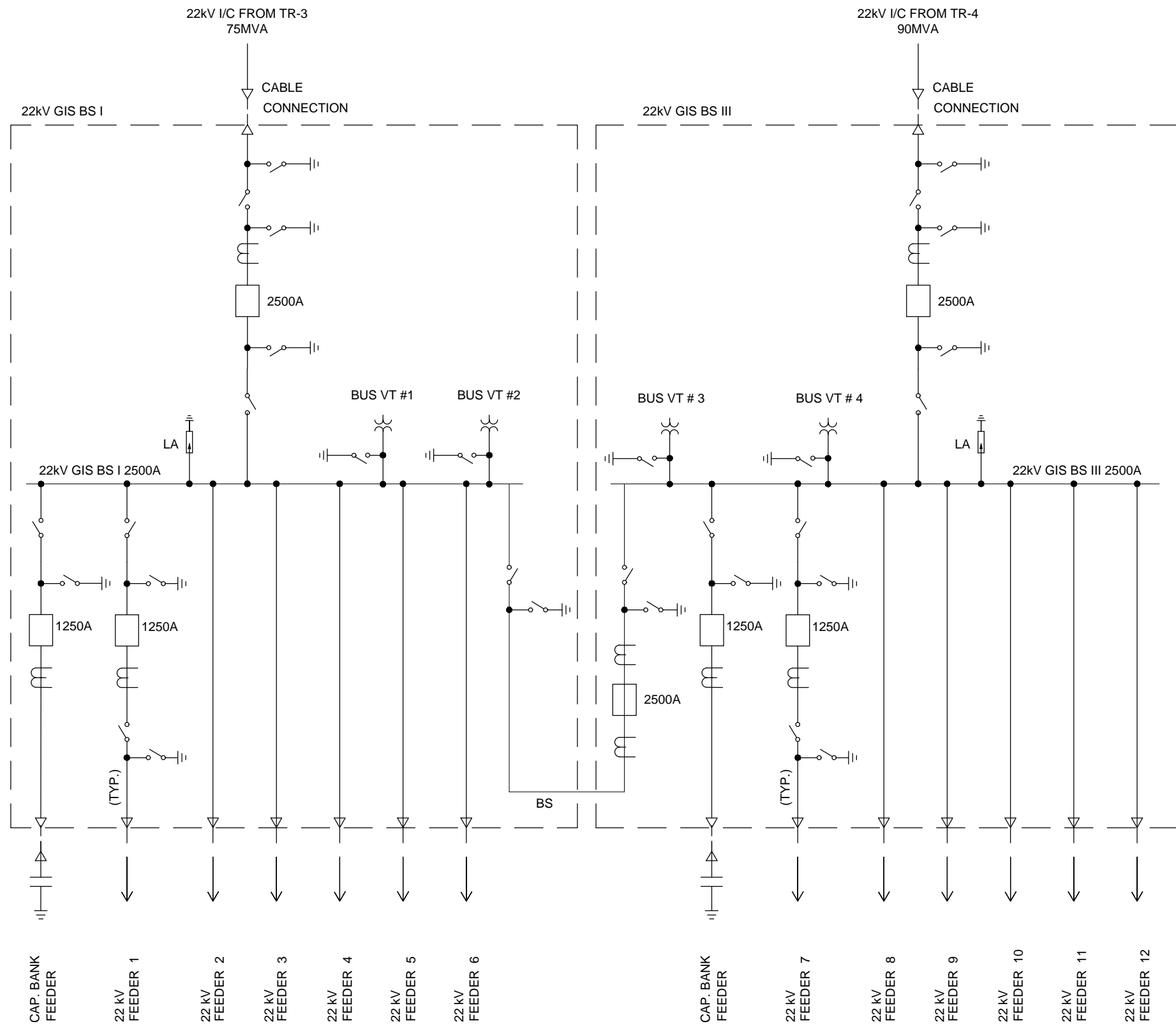
FOR RO ISSUE ONLY			ISSUE	REVISIONS	DRN	CLEARED					APPD	DATE	FILE NAME :	DO NOT SCALE		EXHIBIT - 1.1	EXISTING MAIN ONE LINE DIAGRAM OF CARNAC R/S
DEPT	SIGNATURE	DATE				CHEM	CIVIL	ELEC	I&C	MECH							
CHEM			P0	FOR REVIEW & COMMENTS	JRS												
CIVIL			P1	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 27.04.2011	JRS												
ELEC			P2	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 03.05.2011	ASM												
I&C																	
MECH																	



CLIENT : TATA POWER COMPANY LTD.

PROJECT : CARNAC RECEIVING STATION

SCALE: NTS	APPROVED	DATE (RO ISSUE)
OFFICE-DISC:DI-EL		DATE (CURRENT ISSUE) 03-05-2011
DRN: ASM		
CHD:	DWG NO TCE.5648A-735-CAR-SK-2001	ISSUE P2



LEGENDS

	CIRCUIT BREAKER
	TRANSFORMER
	LA
	CURRENT TRANSFORMER
	ISOLATOR
	PT
	CAPACITOR
	REACTOR

NOTE

- 33kV GIS PROPOSED FOR 22kV AIS B.S. I & III WILL BE OPERATED AT 22kV & NAMED AS 22kV GIS B.S. I & III RESPECTIVELY.

FOR R0 ISSUE ONLY			ISSUE	REVISIONS	DRN	CLEARED					APPD	DATE	FILE NAME :	DO NOT SCALE		EXHIBIT - 1.2	
DEPT	SIGNATURE	DATE				CHEM	CIVIL	ELEC	I&C	MECH				SLD OF 33kV GIS B.S. I & III OPERATED AT 22kV FOR CARNAC R/S			
CHEM			P0	FOR REVIEW & COMMENTS	JRS									SCALE: NTS	APPROVED	DATE (R0 ISSUE)	
CIVIL			P1	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 27.04.2011	JRS									OFFICE-DISC: DI-EL		DATE (CURRENT ISSUE)	
ELEC			P2	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 03.05.2011	ASM									DRN: ASM		03-05-2011	
I&C														CHD:	DWG NO	TCE.5648A-735-CAR-SK-2002	
MECH																ISSUE P2	

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MUMBAI

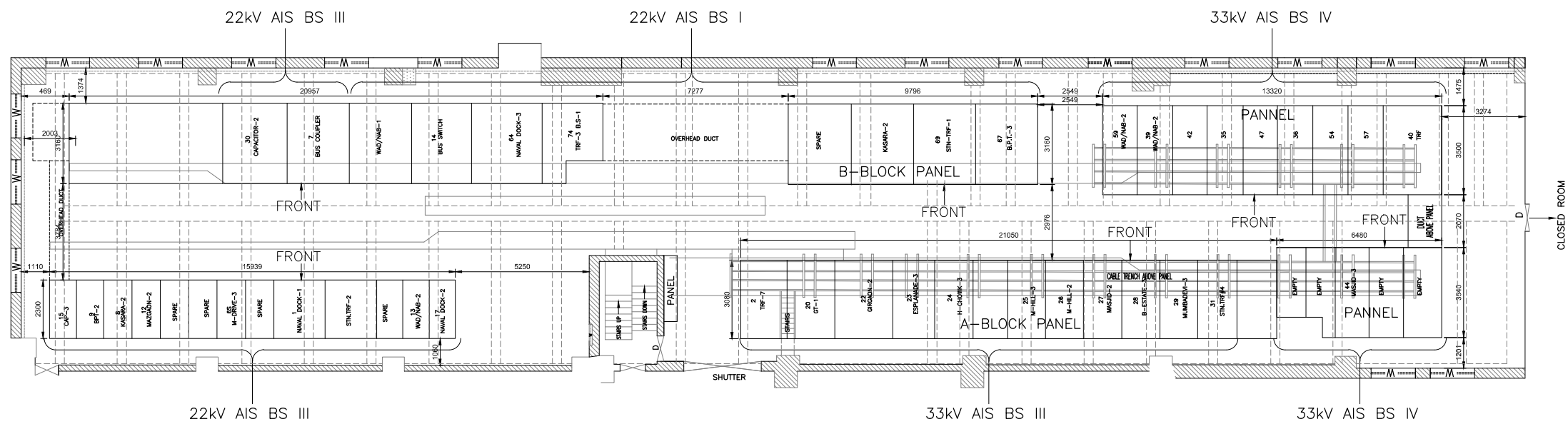
CLIENT : TATA POWER COMPANY LTD.

PROJECT : CARNAC RECEIVING STATION

1P (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK.

CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'HOLD' (RELEASED) ISSUES ONLY.

INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO CLEAR 'HOLD' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLD'.




FIRST FLOOR LAYOUT

FOR RO ISSUE ONLY		
CLEARED		
DEPT	SIGNATURE	DATE
CHEM		
CIVIL		
ELEC		
I&C		
MECH		

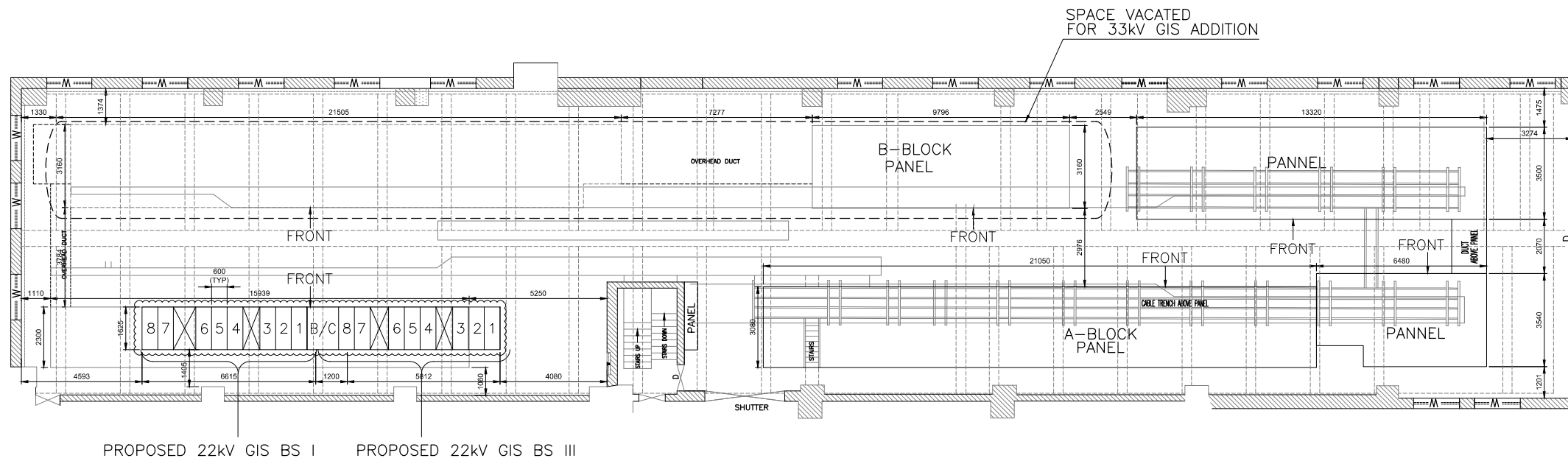
ISSUE	REVISIONS
P0	FOR REVIEW & COMMENTS
P1	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 27.04.2011
P2	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 03.05.2011

DRN	CHEM	CIVIL	ELEC	I&C	MECH	APPD	DATE
JRS							
ASM							

FILE NAME :
P (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK AT THE TOP RIGHT HAND CORNER OF THE TITLE BLOCK. CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'HOLD' ISSUES ONLY. INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST SET DESIGN OFFICE TO CLEAR 'HOLD' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLD'.

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CLIENT :	TATA POWER COMPANY LTD.
PROJECT :	CARNAC RECEIVING STATION

DO NOT SCALE		EXHIBIT - 1.3	
EXISTING GA OF 22/33kV PANELS AT CARNAC R/S (BLOCK A)			
SCALE: 1:200	APPROVED		DATE (RO ISSUE)
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DRN: ASM			03-05-2011
CHD:	DWG NO	TCE.5648A-735-CAR-SK-2003	ISSUE P2




LEGEND

— DUMMY PANEL
B/C — BUS COUPLER

NOTE

1. 33kV GIS PROPOSED FOR 22kV AIS BS I & III WILL BE OPERATED AT 22kV & NAMED AS 22kV GIS BS I & III RESPECTIVELY.

FOR RO ISSUE ONLY										ISSUE	REVISIONS	DRN	CLEARED					APPD	DATE	FILE NAME :	<div><div></div><div>TATA CONSULTING ENGINEERS LIMITED MUMBAI</div></div>	DO NOT SCALE EXHIBIT – 1.4			
	CLEARED						CHEM	CIVIL	ELEC				I&C	MECH	PROPOSED GA OF 22kV GIS B.S. I & III PANELS AT CARNAC R/S (BLOCK A)										
DEPT	SIGNATURE			DATE	P0	FOR REVIEW & COMMENTS					JRS											SCALE: 1:200	APPROVED	DATE (RO ISSUE)	
CHEM					P1	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 27.04.2011					JRS											OFFICE-DISC:DI-EL		DATE (CURRENT ISSUE) 03-05-2011	
CIVIL					P2	REVISED AS PER TATA POWER'S COMMENTS RECEIVED BY e-mail dtd. 03.05.2011					ASM											DRN: ASM			
ELEC																						DWG NO	TCE.5648A-735-CAR-SK-2004	ISSUE	
I&C																								P2	
MECH																									

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CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'HOLD' ISSUES ONLY.

INFORMATION CONTAINED WITHIN 'HOLD' IS NOT RELEASED FOR CONSTRUCTION / FABRICATION. FIELD MUST GET DESIGN OFFICE TO 'CLEAR' 'HOLD' IN TIME BEFORE PROCEEDING WITH ANY CONSTRUCTION / FABRICATION WORK RELATED TO 'HOLD'.

CLIENT :	TATA POWER COMPANY LTD.	OFFICE-DISC:DI-EL	APPROVED	DATE (RO ISSUE)
PROJECT :	CARNAC RECEIVING STATION	DRN: ASM		DATE (CURRENT ISSUE) 03-05-2011
CHD:		DWG NO	TCE.5648A-735-CAR-SK-2004	ISSUE P2

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SECTION II (Replacement of 33kV Bus section I & II by 33kV GIS)

1.1 Purpose and Necessity

The present 33 kV Switchgear located in Block-B is old (installed in 1988) and has an inventory value of Rs 25 lakhs. There are no spares available for the ABB SF₆ circuit breakers. Additional space is required to accommodate additional outlets at 33 kV. It is proposed to retire present 33 kV AIS Switchgear & replace with 33 kV GIS. There is no space in the present location to add any switchgears without giving shutdown. Hence, it is proposed to locate proposed 33kV GIS BS I & II in Carnac block-A after completing section-I work.

1.2 Scope of the Present Report

This DPR covers the replacement of 2 Nos of 33 kV bus sections (ABB) i.e. Bus section I & II by installation of 33 kV GIS comprising 9 Nos feeder outlets, one breaker each for Capacitor bank, Reactor, station transformer for each Bus section, sectionalizer & Incomer (1 no for 33kV GIS BS I and 2 nos for 33kV GIS BS II) in the space available in Block-A. Total no. of feeders will be 14 for 33kV GIS BS I & 15 for 33kV GIS BS II.

2 Nos of 33kV GIS bus sections shall be installed in Carnac block-A and existing loads of 33kV AIS shall be shifted to the new 33kV GIS BS I & II. There are 16 nos. of 33 kV bays to be replaced in all and 9 nos. of 33kV O/G bays are available for catering future loads

1.3 Impact of not carrying out the Project.

The existing 33 kV AIS switchgear being old & also there is no space available in Block-B to add switchgear to cater to additional loads. This will result in loss of revenue, Since BEST has requirement of additional 16 nos. 33kV feeders in next 4 years.

1.4 Implementation Strategy Studied

The following strategy is considered to meet the requirements:

1.4.1 Installation of a replacement 33kV GIS

1.4.1.1 Space is created in block A by replacement of 22kV AIS by GIS as per section I.

It is proposed to install new 33kV GIS BS I & II in this vacant space available in existing 22/33kV Switchgear Room at Carnac Block-A. Exhibit- 2.1 shows a typical SLD of the proposed 33kV GIS.

The step by step procedure for replacing the entire 33kV Switchgear by 33kV GIS shall be as follows:

STEP1:- Installation of 33kV GIS BS I & II in existing 22/33kV Switchgear Room at Carnac Block-A in the vacated space available by dismantling of 22kV AIS Bus sections I & III.

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STEP2:- Shift incomer of BS II (ICT#6) to GIS BS II and GIS BS II will be charged.

STEP3:- GIS BS I shall be charged by closing sectionaliser breaker between GIS BS I & II

STEP4:- Shift the loads from 33kV AIS BS II to New GIS BS II and connect stand by incomer from AIS BS II.

STEP5:- Shift incomers TR#7 to GIS BS II. Open the tie breaker between 33kV AIS Bus section I & II and dismantle AIS BS II

STEP6:- Shift feeders from existing 33kV AIS BS I to new 33kV GIS BS I and also shift ICT#5 to new GIS BS I.

STEP7:- Dismantle existing 33kV AIS BS I.

Thus the entire 33kV Switchgear will be replaced by 33kV GIS BS I & II and relocated at Carnac Block-A. Exhibit-2.2 shows the proposed 22/33kV Switchgear layout after implementation of section I & II. Tie breaker in GIS BS IV shall be used for connection to AIS BS IV in future

2. TECHNICAL DETAILS OF IMPLEMENTATION STRATEGY

2.1 Scope of Work

Installation of new 33kV GIS I & II in Carnac Block A and shifting of existing load from 33kV BS I & II located in Carnac Block B

2.2 Technical requirements

2.2.1: 33 kV GIS Switchgear

Proposed 33kV GIS switchgear will be single bus type with BCPUs for control and protection.

Based on the number of incoming and outgoing feeders, it is proposed to have 15 bays (for GIS BS II) and 14 bays (for GIS BS I) in the 33kV GIS as follows:

For each bus section

- Outgoing Bays – 9 nos
- Capacitor bank bay- 1 no.
- Reactor bank bay- 1 no
- Station TRF bay-1 no

1 No. incomer & Sectionaliser for GIS BS I and 2 nos. of incomers & tie for GIS BS II

2 nos. of 33kV PT sets to be provided for each bus section.

The proposed 33 kV GIS will be located in the 22/33kV Switchgear room, in Block -A.

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The basic technical requirements of 33kV GIS will be as follows:

Fault Level: 31.5 kA, 3 sec.

Highest System Voltage: 36 kV (rms)

Basic Impulse Level: Impulse withstand: 170 kV (peak)

One minute power frequency voltage: 70 kV (rms)

Continuous current rating of Busbar: 2500A

Current rating of Incomer and tie breaker: 2500A

Current rating of outgoing feeder breakers: 1250A

The above is in line with standard ratings of 33kV GIS installed in Tata Power system at other substations.

2.2.2 33 kV Power Cables

The 33 kV cables of extra length will be required for supply and loads.

Rated voltage	Nominal 33 kV, Max. 57 kV
Insulation	XLPE
Conductor size	630 sq.mm
No. of cores	Single core
Conductor material	Plain Copper
Sheathing	PVC outer sheath
Current Rating	660 A
Overall derating factor	0.75 (conservative)
Current rating after derating	495 A
Short circuit capacity required	90 kA, 1 sec required
Approx. overall diameter of	65.5 cable (mm)
No. of runs required for incomer And tie cable	4 Runs/Phase

2.2.3 Protection, Control and Monitoring

For 33 kV system only BCUs with over current protection are proposed to be provided and no backup control panels are envisaged.

In addition to the provision for local control from 33kV GIS Bay itself, remote control of the breakers from SCADA is envisaged.

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Proposed Scheme of integration to SCADA:

It is proposed to commission the BCUs and BCPUs along with Gateways at R/S and integrate these gateways (33kV GIS) to the following systems:

- a. Unified SCADA System being commissioned at CCR Dharavi.
 - b. Nodal SCADA System
 - c. AREVA SCADA System at Load Control Centre Trombay.
1. BCPUs for 33kV GIS bays (29 nos.) will be mounted on LV compartment of GIS (supplied by GIS Vendor). These BCPUs shall communicate on IEC61850 to redundant Gateways installed in separate panel for all 33kV Bays. These redundant gateways will also communicate to SCADA masters at Dharavi (Unified SCADA System), Carnac R/S SCADA (Nodal System) and LCC Trombay (AREVA System) on IEC104.
 2. The systems to be procured and services required for the above project are as follows:

From the GIS Vendor:

- i. BCPUs for 33kV Bays
- ii. Energy Meters for all 33 kV bays ,
- iii. Gateways with Ethernet switch
- iv. Auxiliary relays for Digital outputs
- v. Networking equipment and accessories
- vi. Services

2.2.4 Auxiliaries and Other Facilities

415 V AC & DC supply for the 33 kV GIS will be taken from the existing distribution board. Additional sub-distribution boards will be proposed during detailed engineering, if required.

Earthing system is to be provided for the system in line with standard practices.

Communication facilities in line with the standard practice followed in the other main receiving stations shall be provided in the proposed building.

2.3 Location and Space Requirement

After implementation of section I it is proposed to locate the new 33kV GIS BS I & II in the vacant space (38m X 3.2m) available in existing 22/33kV Switchgear room at Carnac block A. It is shown in Exhibit 2.2.

2.4 Time period involved

The project schedule shown in Appendix-2.1 is drawn based on the delivery data furnished by vendors and available with TCE for similar other projects.

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The complete time period required for this project is of 18 months. During this period complete project will be executed right from designing stage to commissioning stage.

The above schedule assumes that the procurement activity for the major equipment such as 33kV GIS will be based on the standard design philosophy adopted by Tata Power.

2.5 Statutory Approvals Required

Electrical Inspector's approval will be obtained for the electrical layout.

3. Financial Details

3.1 Total Estimated Expenditure

Cost of major items comprising of 33kV GIS, SCADA and protection system up gradation are mainly from budgetary estimates furnished by vendors and recent orders will be placed by them for similar project.

Cost of 33kV GIS is based on the cost incurred on similar project, in the recent past. Sales tax, excise duties and octroi duties are incurred on indigenous equipment.

An annual price escalation and physical contingency together is considered as 2.0% to cover possible differences between actual and estimated quantities, commission of minor items of work, possible minor changes at project execution stage and unforeseen items.

The total cost of the project inclusive of 33kV GIS, 33kV Cables etc. is estimated as Rs. 1475 lakhs.

3.2 Cost Break-up

Detailed total cost estimate of the project is furnished in Appendix 2.3. The basis for the cost estimate is furnished in Appendix-2.4.

3.3 Source of Funding

It is proposed to fund the project either from internal accruals or from reputed leading institutions.

3.4 Phasing of Expenditure

Based on the delivery schedule for the various items and the project schedule, the estimate of the phasing of the expenditure on yearly basis is drawn up and is as enclosed in Appendix – 2.6.3.

3.5 Cost Benefit Analysis (CBA)/ Tariff Impact

A detailed CBA with assumptions is indicated in Appendix – 2.6.4.

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4.0 BENEFITS OF THE PROJECT

4.1 Tangible

The present 33 kV Switchgear is more than 50 yrs old (having an inventory value of Rs 25 lakhs) and have maintenance problems and have lack of spares. We also need space to accommodate additional outlet of 33 kV. Hence, without constructing any new building and increasing the expenditure, it is proposed to retire present 33 kV & replace with 33 kV GIS. This will increase revenue by power supply to additional consumers.

4.2 Benefit to the Customers

Customers will get more reliable and continuous supply, with reduced failure rate & maintenance requirement. More customers can be fed from the network.

4.4 Indirect Savings / Improvements

The existing 33kV switchgear BS I & II shall be replaced by new 2 nos of 33kV GIS bus section I & II. This shall enhance the reliability of the power supply as well as reduce the maintenance cost for the switchgear. Further, since GIS is compact as compared to conventional switchgear, provisions for more no. of outlets can be made at a higher voltage level without constructing new building. It is also proposed to standardize the bus sections. There will be increased safety & reduced maintenance for the O&M people.

5.0 RECOMMENDATION AND CONCLUSION

Since the 33kV bus sections breakers have out lived their life, it is recommended to replace them by new 33kV GIS for reliability, which reduced failure rate & maintenance requirement.

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Appendix –2.1

(Estimated Project Schedule for installation of 33kV Bus sections)

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APPENDIX-2.1

Estimated Project Schedule for Proposed Installation of 33kV GIS at Carnac R/S

Monthwise Activities

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DESIGN ENGINEERING																		
PERMISSION FROM CONCERNED AUTHORITIES																		

PREPARATION OF TENDER DOCUMENTS

RELOCATION OF EXISTING FEEDERS & THEIR CIVIL WORK																		
33kV GIS BS I & II																		
OTHER FACILITY LIKE AUX.MISCELLANEOUS ITEMS																		
CABLES, CABLE ACCESSORIES																		

PLACEMENT OF ORDER

CIVIL WORK																		
33kV GIS BS I & II																		
CABLES																		
CABLE ACCESSORIES																		
OTHER FACILITY LIKE AUXILIARY, MISCELLANEOUS ITEMS																		

VENDOR DRAWING REVIEW

33kV GIS BS I & II, OTHER ELECTRICAL EQUIPMENT																		
CABLES																		
CABLE ACCESSORIES																		
MISCELLANEOUS ITEMS																		

APPENDIX-2.1

Estimated Project Schedule for Proposed Installation of 33kV GIS at Carnac R/S

Monthwise Activities

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SITE ACTIVITY																		
CIVIL WORK FOR RELOADED FEEDERS & PROPOSED GIS																		
SUPPLY INSTALLATION, TESTING AND COMMISSIONING OF 33kV GIS BS I & II AND OTHER ELECT. EQUIP. IN PHASES																		
SUPPLY AND INSTALLATION OF AUXILIARY & MISCELLANEOUS ITEMS																		
SUPPLY OF CABLE ACCESSORIES, SHIFTING OF FEEDERS AND TERMINATING ON GIS																		

NOTE:

1. Total duration of implementation of the scope of this DPR is 18 months starting from design activity upto end of commissioning of entire system.

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Appendix –2.2

**Estimated Load (in MVA) at Tata Power's Carnac R/S
(Up to year 2014)**

Year	load at Carnac R/S (33 kV) in MVA
2010-2011	240
2011-2012	253
2012-2013	268
2013-2014	284

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Appendix – 2.3

Cost Estimates for Proposed Project (Replacement of 2 nos. Of 33kV Bus sections)

Sr. No.	Description	Qty	Unit	Unit Price (Lakhs)	Item Price (Lakhs)	Remark
1	Civil works for 33kV GIS Installation	1	LS	40	40	
2	Procurement of 33kV GIS complete with CTs, Dummy Panels disconnections, BCU/ BCPU equipment (29 bays)	2 (29 bays)	set	464	928	For details of no. of bays ref clause no. 2.2.1 of section II
3	33kV, 1 C X 630 Sq. mm Cu- XLPE Cables	4500	m	0.04	180	
4	Installation of 33kV cable terminations for bays	20	Set	0.25	5	
5	Aux. System (earthing, cable trays etc) - lump sum	1	LS	24	24	
6	LV Power & control cables	1	LS	28	28	
7	Services for SCADA integration Trombay, Dharavi, Carnac	1	LS	36	36	
8	Installation, erection, testing & commissioning of all equipments	1	LS	36	36	
9	Consultancy Services	1	LS	4	4	
10	Staff cost		LS		60	
11	Provision for contingencies @ 3%				27	
12	IDC				107	
13	Total Project Cost				1475	

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Appendix 2.4 **Basis of Cost estimate**

The details and the basis of cost estimates of the major items included in the cost estimates of the proposed project, are as follows:

- **33 kV GIS**
 - Required number of bays equipment with single bus bar arrangement including maintenance tools and supervision of erection and commissioning.
 - The cost estimate of 32 Lakh per bay is considered based on recent 33 kV GIS projects
- **SCADA : computer based SCADA system**
 - The cost estimate is based on earlier work done.
- **Control and Protection Panels**
 - Cable incomer feeders (Includes distance protection, backup directional over current and earth fault protection with energy meter and all other auxiliary relays and devices)
 - Bus bar protection, sequence of events recorder and annunciation panels
 - The cost estimate is based on recent GIS project of Tata Power.
- **Power cables and accessories**
 - 33 kV, 1C x 630 sq.mm copper XLPE insulated single core cables for incomer feeders
 - Pre mounted straight joints for joining 33 kV cables
 - Cost estimation is based on recent projects of Tata Power
- **Civil Works**
 - Based on the quantum of work and past experience in similar recently executed projects by Tata Power.
- **Auxiliary System**
 - The cost estimate is based on past experience.
- **Miscellaneous costs and provision for contingencies**
 - Physical contingency has been provided to cover possible differences between actual and estimated quantities, omission of minor items of work, possible minor changes at project execution stage and unforeseen items.
- **Preliminary works, investigation and design engineering**
 - The costs are considered typically based on recently executed projects.

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Appendix – 2.5
(Estimated Expenditure during Project Execution)
(By Tata Power)

Year	Estimated Cost in Rs. Lakhs
FY-13	1252
FY-14	223
Total	1475

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Appendix – 2.6

(Financial Calculations)

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APPENDIX: 2.6.1

Assumption -Technical , Commercial and Financial:**Transmission****Replacement of 33 KV Bus Sections I & II at Carnac**

A	<u>Technical & Commercial</u>		
1	<u>O & M Cost</u>		
	O & M Cost as Percent of Completed Capital Cost	4.0%	Percent
	Escalation of O & M Cost per year	2.5%	Percent
3	<u>Project Duration</u>		
	<u>Project Starts</u>	FY13	
	<u>Estimated Construction Period</u>	18	Months
	<u>Operation Commences</u>	FY14	
B	<u>Financial Assumptions</u>		
1	<u>Structure</u>		
	Loan/Debt	70.0%	Percent
	Equity	30.0%	Percent
	<u>Income Tax</u>		
2	Rate of Tax- Corporate Tax	33.66%	Percent
	<u>Debt</u>		
3	Rate of Interest on Debt/Loan	11.5%	Percent
	Loan repayment period	10	Years
4	<u>Depreciation</u>		
	Depreciation as per Electricity Act/Tariff	3.60%	%
	Depreciation as per Income Tax Act	15.00%	%
5	<u>Interest During Construction</u>		
	Whether Capitalized or Written Off	Capitalized	(Old Written iff)
6	<u>Staff Costs</u>		
	Average CTC of Technician/Year	5.5	Rs.Lakhs
	Average CTC of Engineer/Year	8	Rs.Lakhs
	Escalation Rate: Salary (%)	14%	Rs.Lakhs
	<u>State Transmission System as per Intra state Order (ARR)</u>		
	Total Transmission System Cost	265,373	Rs Lakhs
	Escalation in Transmission system cost	2.5%	% p.a
	Reasonable Return on Equity	14%	Percent
	Total Sales -MSEDCL	70,480	MUs
	Total Sales -REL	8,424	MUs
	Total Sales -BEST	4,390	MUs
	Total Sales -Tata Power-D	3,990	MUs
	Total Sales of all Distribution Utilities	87,284	MUs
	Growth in electricity sales	5.0%	%
	Transmission losses	4.85	%
	<u>Additional Average Peak Transission Capacity</u>		
	Average Peak Transmission Capacity added due to this project	Not Applicable	MVA

APPENDIX:2.6.2

BRIEF PROJECT COST ESTIMATE		
Replacement of 33 KV Bus Sections I & II at Carnac		
		Rs Lakhs
1	Civil Works for 33 KV Bus	40
2	Procurement of GIS complete with CTs, Dummy panels disconnections, BCU/BCPU equipment	928
3	33 KV 1C*630 Sq mmCopper XLPE cables for shifting transformers to new bus	180
4	Installation of 33 KV cable terminations for bays	5
5	Aux sysytem(Earthing , cable trays etc) Lump sum	24
6	LV Power & control cables	28
7	Services for SCADA Intergrationat LDD ,Dharavi, Carnac	36
7	Installation errection , testing & commissioning chargesfor all equipment	36
8	Consultancy services	4
9	Staff cost @ 5% of material cost	60
10	Provision for contingency @ 2 %	27
17	IDC -Interest During Construction	107
	TOTAL PROJECT COST (incl. IDC)	1475

APPENDIX:2.6.3

A. PHASING OF EXPENDITURE:

Replacement of 33 KV Bus Sections I & II at Carnac

				1	3	7	11	14	15	18
				FY13	FY13	FY14	FY14	FY14	FY14	FY14
		FY13	FY14	Oct	Dec	Apr	Aug	Nov	Dec	Mar
				1	1	1	1	1	1	1
Phasing of Expenditure	Total									
	Rs. Lakhs									
Civil Works for 33 KV Bus	40	40.00		40						
Procurement of GIS complete with CTs, Dummy panels disconnections, BCU/BCPU equipment	928	928.00			928					
33 KV 1C*630 Sq mmCopper XLPE cables for shifting transformers to new bus	180	180.00			180					
Installation of 33 KV cable terminations for bays	5	5.00			5					
Aux sysytem(Earthing , cable trays etc) Lump sum	24	24.00			24					
LV Power & control cables	28	28.00			28					
Services for SCADA Intergrationat LDD ,Dharavi, Carnac	36	3.63	32.63		4	7	7		7	11
Installation errection , testing & commissioning chargesfor all equipment	36	3.60	32.40		4	7	7		7	11
Consultancy services	4	0.40	3.60		0.4	1	1		1	1
Staff cost @ 5% of material cost	60	6.03	54.23		6	12	12		12	18
Provision for contingency @ 2 %	27		26.83							27
IDC -Interest During Construction	107									
Total Project Cost	1475	1219	150	40	1179	27	27		27	68
Capitalization Phasing with IDC	1475		1475					1379		96
Cumulative Capitalization with IDC	1475		1475					1379	1379	1475

B. IDC Calculation

Expenditure

Expenditure-Phasing	1368	1219	150	40.00	1178.65	27.30	27.30		27.30	67.78
Expenditure-IDC	107	34	73	0.27	8.23	8.64	9.06	9.25	0.18	0.65
Expenditure-Total with IDC	1475	1252	222	40.27	1186.88	35.94	36.36	9.25	27.48	68.43
Cumulative Expenditure-Total with IDC	1475	1252	1475	40.27	1227.43	1288.41	1351.05	1378.61	1406.09	1474.89
Disbursal of Indian Loan and Equity										
Cumulative Equity	30%	376	442	12.08	368.23	386.52	405.32	413.58	421.83	442.47
Equity		442	376	12.08	356.07	10.78	10.91	2.77	8.25	20.53
Loan		1032	877	28.19	830.82	25.16	25.45	6.47	19.24	47.90
Cumulative Loans	70%	877	67	28.19	859.20	901.88	945.74	965.03	984.27	67.40
Capitalization during previous month									1378.61	
Balance Cum Loan for IDC		877	67	28.19	859.20	901.88	945.74	965.03	19.24	67.40
Interest During Construction -IDC	107	34	73	0.27	8.23	8.64	9.06	9.25	0.18	0.65
Cumulative IDC	107	34	107	0.27	8.78	42.46	77.80	105.36	105.54	106.56

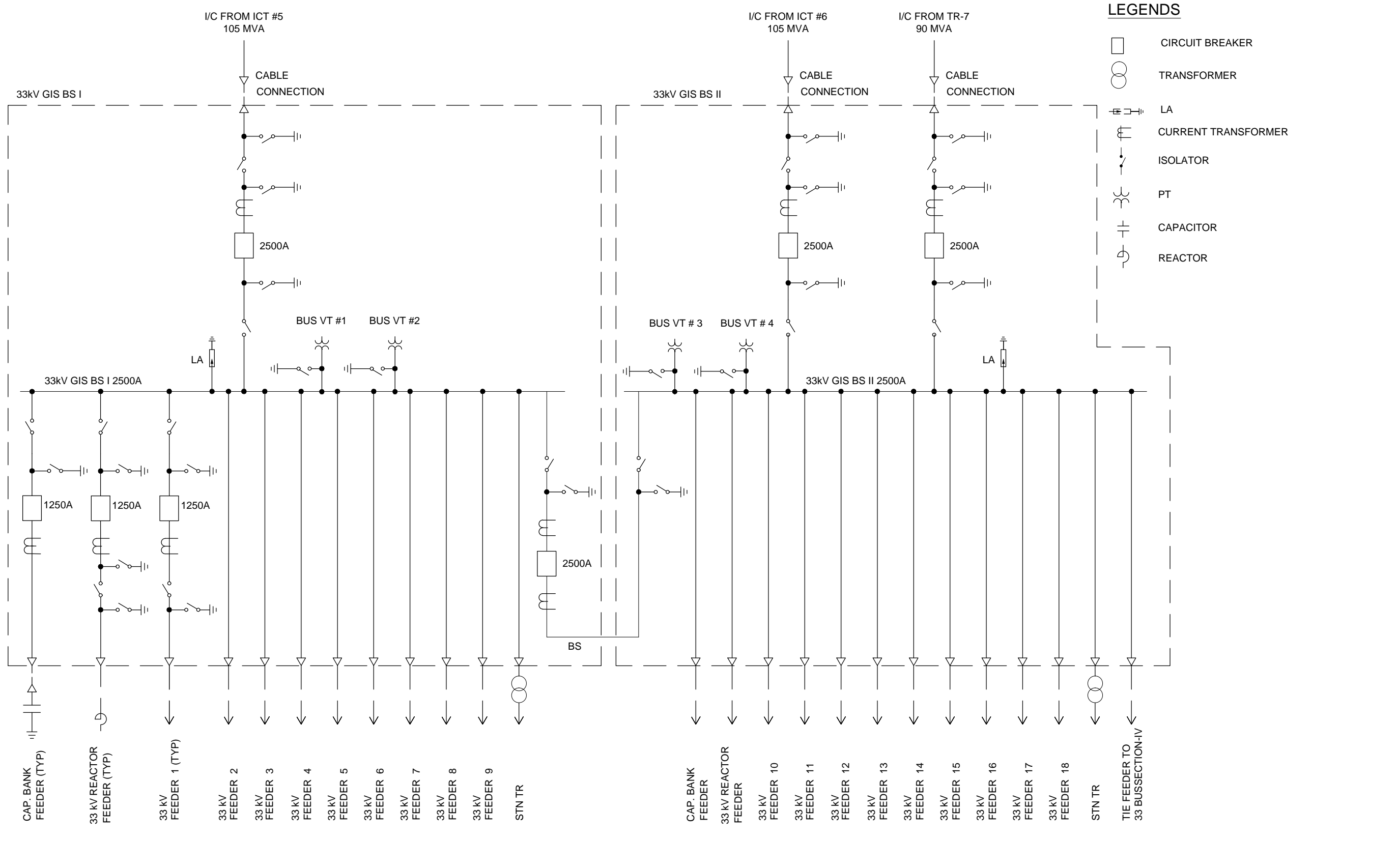
Replacement of 33 KV Bus Sections I & II at Carnac

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BACK UP CALCULATIONS:

Replacement of 33 KV Bus Sections I & II at Carnac

		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Year Ending		FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28
Project Capitalization	Rs Lakhs	0	1475	0	0	0	0										
Project Capitalization -Cumulative	Rs Lakhs	0	1475	1475	1475	1475	1475										
Costs Due to this project																	
O & M Expenditure																	
O & M Expenses	Rs Lakhs		0	59	61	64	66	69	72	75	78	81	84	87	91	94	98
Interest on borrowings after project completion																	
Opening Balance	Rs Lakhs		0	1032	929	826	723	619	516	413	310	206	103	0	-103	-206	-310
Repayment	Rs Lakhs		0	103	103	103	103	103	103	103	103	103	103	103	103	103	103
Closing Balance	Rs Lakhs		0	929	826	723	619	516	413	310	206	103	0	-103	-206	-310	-413
Interest on borrowings	Rs Lakhs		0	119	107	95	83	71	59	47	36	24	12	0	-12	-24	-36
Interest During Construction	Rs Lakhs	34	73	0	0	0	0										
Tariff/Book Depreciation																	
Depc	Rs Lakhs		0	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Accum Depc	Rs Lakhs	0	0	53	106	159	212	265	319	372	425	478	531	478	531	584	637
Income Tax Depreciation																	
Opening WDV	Rs Lakhs	0	0	1475	1254	1066	906	770	654	556	473	402	342	290	247	210	178
Depc	Rs Lakhs	0	0	221	188	160	136	115	98	83	71	60	51	44	37	31	27
Project Capitalization	Rs Lakhs	0	1475	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Closing WDV	Rs Lakhs	0	1475	1254	1066	906	770	654	556	473	402	342	290	247	210	178	152
Return on Equity	14%																
Additions to Gross Block -Capitalization	Rs Lakhs		0	1475	0	0	0	0									
Removal from Gross Block	Rs Lakhs	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Block/Capex	Rs Lakhs	0	0	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Equity Component	Rs Lakhs	0	0	435	435	435	435	435	435	435	435	435	435	435	435	435	435
Return on Equity	Rs Lakhs	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Incremental Income Tax																	
Return on Equity	Rs Lakhs	0	0	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Add Book Depc	Rs Lakhs	0	0	53	53	53	53	53	53	53	53	53	53	53	53	53	53
Less Tax Depc	Rs Lakhs	0	0	221	188	160	136	115	98	83	71	60	51	44	37	31	27
Tax @33.66%	Rs Lakhs	0	0	-54	-38	-23	-11	-1	8	16	22	27	32	36	39	42	44



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		TATA CONSULTING ENGINEERS LIMITED	
		MUMBAI	


CLIENT :	TATA POWER COMPANY LTD.
PROJECT :	CARNAC RECEIVING STATION

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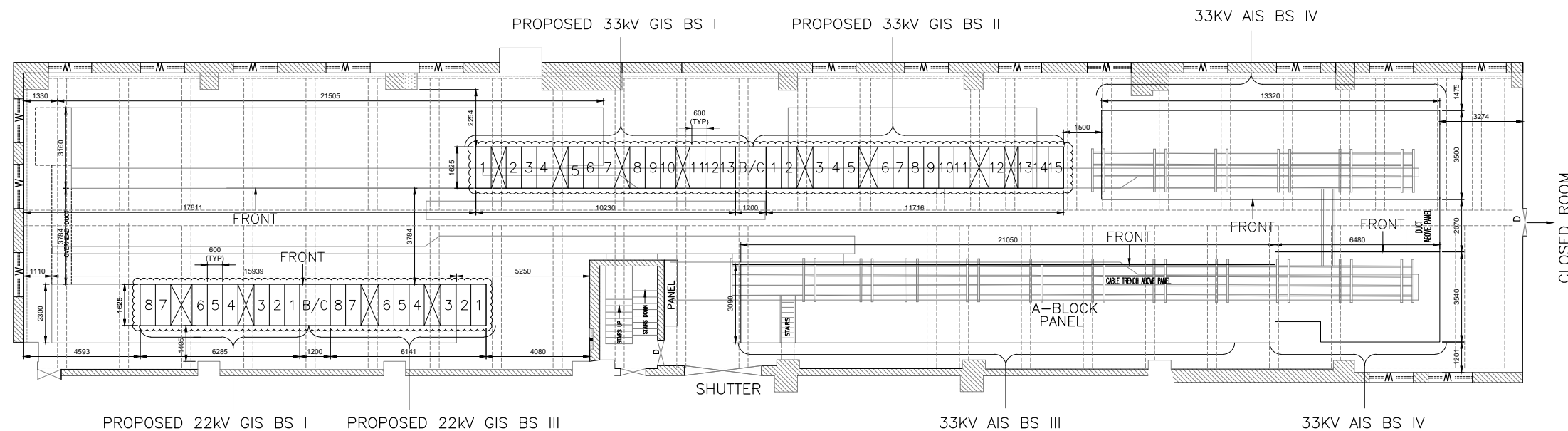
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MUMBAI

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PROJECT : CARNAC RECEIVING STATION

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- DUMMY PANEL
B/C — BUS COUPLER

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