ELECTRICIDADE DE MOÇAMBIQUE, E.P. (EDM)
MINISTRY OF MINERAL RESOURCES AND ENERGY
THE REPUBLIC OF MOZAMBIQUE

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION NETWORK IN NACALA CORRIDOR
IN
THE REPUBLIC OF MOZAMBIQUE

FINAL REPORT

MARCH 2015

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
TOKYO ELECTRIC POWER SERVICES CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to ORIENTAL CONSULTANTS GLOBAL CO., LTD / TOKYO ELECTRIC POWER SERVICES CO., LTD. JV.

The survey team held a series of discussions with the officials concerned of the Government of the Republic of Mozambique, and conducted a filed investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Mozambique for their close cooperation extended to the survey team.

March, 2015

Takumi UESHIMA
Director General,
Industrial Development and Public Policy Department
Japan International Cooperation Agency

SUMMARY

1. Country Brief

The Republic of Mozambique is a country in Southeast Africa bordered by the Indian Ocean to the east, Tanzania to the north, Malawi and Zambia to the northwest, Zimbabwe to the west, and Swaziland and South Africa to the southwest, and its land area is 799,000 km^2.

The country is divided into two topographical regions by the Zambezi River. To the north of the Zambezi River, the narrow coastline moves inland to hills and low plateaus, and further west to rugged highlands. To the south of the Zambezi River, the lowlands are broader with the Mashonaland plateau and Lebombo Mountains located in the deep south.

Mozambique has a tropical climate in the northern region and a subtropical climate in the southern region with two seasons, a wet season from November to April and a dry season from May to October. Annual precipitation in the northern region ranges from 1,000 mm to 1,400 mm, and less in the southern region.

The population of Mozambique is 25.8 million (2013: World Bank). The project site is in the Namialo area belonging to the Meconta district of the Nampula province, located about 80 km east of the third largest city in Mozambique, Nampula,, and about 90 km west of the major port in the northern region, the Nalaca port.

After the conclusion of the civil war in 1992, the country enjoyed remarkable recovery in its economic growth and maintains an economic growth rate of 7~8% in recent years. However, GNI per capita is 590 US dollars (2013: World Bank) and the poverty rate is 54.7% (2009: World Bank). Mozambique is still one of the least-developed countries in the world.

The industrial structure consists of 29% agriculture, 20.8% industry, and 50.2% service industry. About 80% of the nation are engaged in agriculture mainly for home and neighbouring use with low productivity. On the other hand, Mozambique is a country wealthy in natural resources such as coal and natural gas. Large-scale development projects by international companies and investments in the development of related infrastructures are driving recent economic growth.

2. Background and Summary of the Project

Mozambique's power demand rapidly increases annually at a rate of more than 10% due to its latest strong economic development; however, its national electrification rate still remains at 22% as of 2012. In addition, the national grid consists of three regional grids (Northern, Central and Southern areas), but the regional grids are not linked to each other. Consequently, the Northern and Central

electrification rate remains at only 14% as of 2012, which is considerably lower than the Southern rate of 50%.

The Northern and Central grids depend on the Cahora Bassa hydro-power Plant ("HCB") with a capacity of 2,075 MW as its major power source. However, much of the HCB power is exported directly to South Africa which means the Northern and Central grids can't meet increasing demand due to very limited generation resources. As such, it is crucial to develop new power generation and to reinforce the existing transmission and substation network.

Regarding the Northern and Central areas, the Nacala corridor area (Cabo Delgado, Niassa, Nampula, Tete, and Zambezia provinces) faces expanding power demand; specifically, the Nacala area in the Northern grid depends on a single transmission line from the Nampula 220 substation for its power supply, which causes an unstable power supply as well as the unfavorable effect of overloading Nampula 220 resulting in the deterioration of neighbouring substations. From this point of view, it is an imminent issue to ensure a stable and reliable power supply for the Nacala area.

Under these circumstances, the Mozambique Government requests that Japan create a "project for reinforcement of the transmission network in the Nacala corridor" in order to ensure a stable power supply to the Nacala corridor area by improving transmission lines and substation facilities.

3. Summary of Study and Components of the Project

(1) Summary of Study

This preparatory survey proposes the appropriate project components for the stable power supply in the Nacala corridor that will be a necessary and optimum investment as Japan's Grant Aid project.

The survey in Mozambique was conducted according to the schedule mentioned below and, as a result of these survey works, JICA and EDM, the counterpart of the project, agreed to the project components and scope of the works for both countries.

- The first survey: 13/4/2014-4/5/2014
  Site survey and discussions with EDM on the project scope and components
- The second survey: 1/6/2014-21/6/2014
  Site survey and discussions with EDM on the undertaking between EDM and JICA
- The third survey:10/1/2015-18/1/2015
  Agreement on the project components and undertakings by EDM

(2) Components of the Project

The project shall be composed of the following main components.

- Construction of a new Namialo substation
- Construction of new transmission towers for connection to the Namialo substation
- Construction of new outgoing distribution lines from the Namialo substation
- SCADA system for the Nampula Central station, Nampula 220, and Namialo substation (including two channels of PLC communication lines for SCADA data exchange)
- Distribution transformers for non-electrified communities (including connection and installation of MV lines)

1) Outline of the Equipment

Outline of the equipment for the project is shown in the tables below.

Table-1 Namialo substation equipment

Item	Equipment	Function
110kV Substation equipment	Main Transformer (40MVA)	Step down voltage from 110kV to 33kV
	Circuit Breaker	Break off load current and fault current in appropriate manner
	Disconnector	Switch the connection, isolate the equipment from the active line and close the circuit
	VT(Voltage Transformer)	Measure voltage of lines and busbar
	CT(Current Transformer)	Measure current of lines and busbar
	Surge Arrestor	Discharge abnormal voltage surge to earth when the line is affected from lighting surge
	Busbar material	Constitute double busbar structure of the substation
	Switch board	Remote control of substation equipment and installation of a protective relay for tripping the circuit breaker in case of equipment failure
33kV Substation equipment	Feeder cubicle	Install 33 kV switchgear, an in-house power supply transformer for substation equipment operation, and a protective relay for 33 kV line failure
Power supply equipment	DC power supply board	DC power for substation equipment operation in case of external outage
	EG (Emergency Generator)	Emergency generation power to operate substation equipment even if power outage continues for an extended duration

Table-2 Transmission towers for connection to the Namialo substation

Item	Equipment	Function
Tower	Double circuit transmission tower	Construct two tension-type towers to draw the lines to the Namialo substation
Tower	Double circuit tentative transmission tower	Construct a tentative tower for detouring lines during substation construction to ensure safety clearance above the substation site

Table-3 SCADA system

Item	Equipment	Function
SCADA	SCADA	Install SCADA system at Nampula Central, Nampula 220 and Namialo substation used for monitoring and control of respective substation equipment Nampula Central is capable of supervisory control over Nampula 220 and Namialo as host control center
SCADA	110kV PLC device	A telecommunication device for data exchange of the SCADA system is used by power line carrier transmission method

Table-4 Distribution transformer

Item	Equipment	Function
Distribution transformer	LV Transformer	Step down voltage from 33kV to 400V

2) Outline of the Facilities

Facilities required for the installation of equipment are composed of foundations for equipment and transmission towers, buildings (the control building and guard house), and exterior works for the Namialo substation.

4. Estimated Project Cost and Implementation Schedule

The project cost to be born by Mozambican side is estimated at 54.75 million yen for the project implementation under the Japanese Grant Aid scheme.

The implementation period is estimated to be 28 months in total, comprising 9 months for the detailed design and tender and 18 months for the procurement and construction.

5. Project Evaluation

(1) Relevance

The improvement of the electric power infrastructure is one extremely important challenge for Mozambique to achieve sustainable economic development, and the Japanese government promotes the "Nacala Corridor Development and Infrastructure Programme". This project contributes not only to a stable power supply in the Northern region of Mozambique but also to the economic development of the Nacala corridor.

(2) Effectiveness

1) Quantitative Evaluation

The project is expected to achieve the quantitative effectiveness as follows after completing the construction of the Namialo substation, on account of its aim to contribute to the improvement of a stable power supply in the Nacala corridor area by reinforcing the transmission network.

Table-5 Quantitative Effectiveness Index

Index	Base Value (2014)	Target Value (2020*) *3 years after the completion
1.110kV/33kV Substation installed capacity in the Namialo and Monapo area (MVA) (*1)	16	56
2.110kV/33kV Transformer load factor（%）	56	38

Note: (*1) Substation capacity is the sum of Namialo and Monapo substation capacity.

2) Qualitative Evaluation

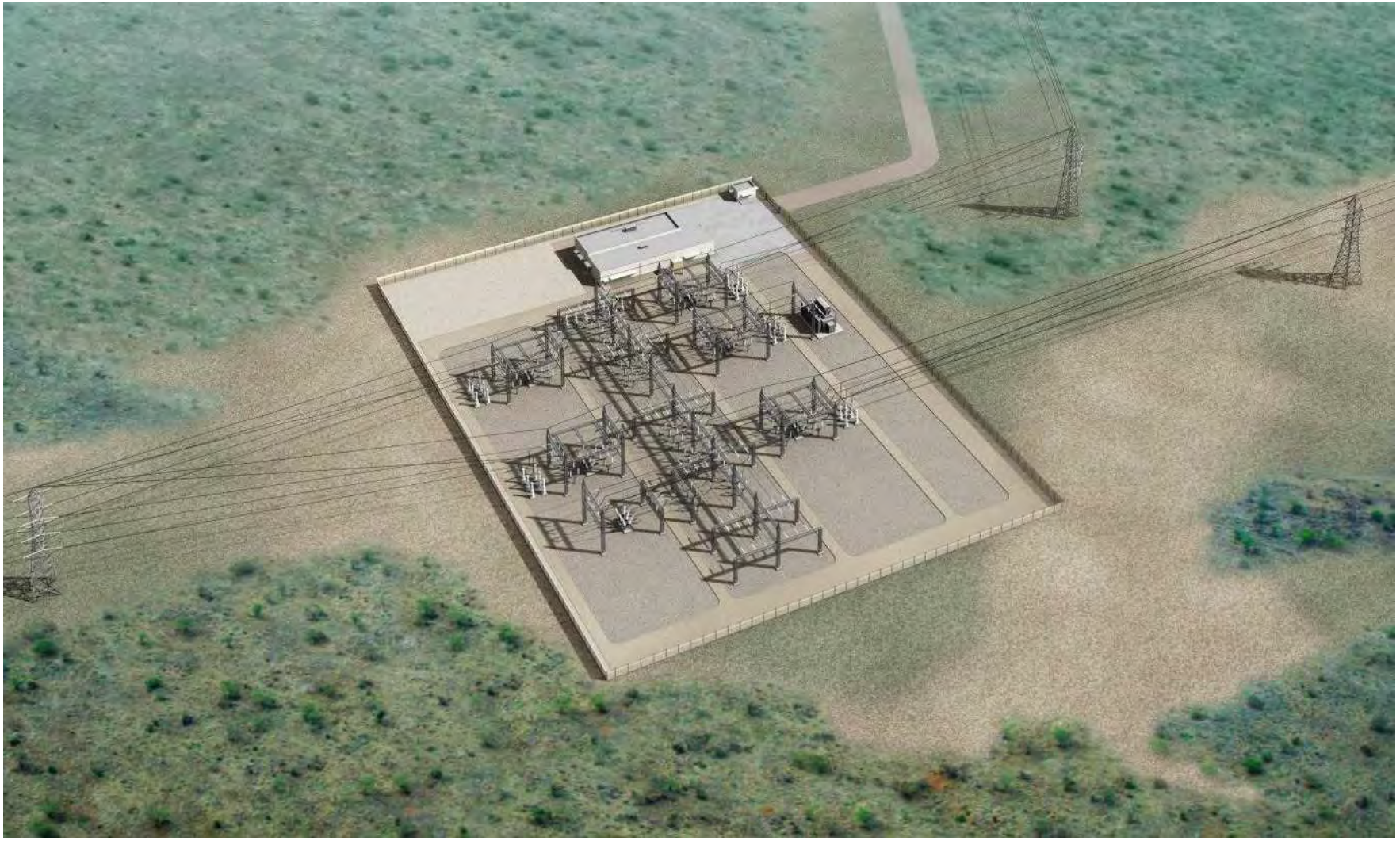
Construction of the Namialo substation will enforce the 33 kV distribution power supply capacity in the Namialo area. Additionally, since some portion of Monapo demand can be transferred to the Namialo substation, both Namialo and Monapo can afford sufficient power service; consequently, the project can encourage the economic development and the improvement of living standards in this area.

CONTENTS

[Appendices]

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. MICOA Decision Letter to EDM on EIA for Namialo SS
6. Loss of Harvest Compensation Table (Nampula Province)
7. Inventory of Lost Assets and Valuation
8. SLUCP Monitoring Form-Monthly Progress Report (Internal Monitoring)
9. Activities Monitoring Form of SLUCP (External Monitoring)
10. Indicator-wise Monitoring Results during Report Period
11. Environmental Checklist for Namialo SS Project
12. Details of the selection of non-electrified communities for distribution transformers
13. Simplified Environmental Study (SES)
14. Simplified Land Use Compensation Plan (SLUCP)
15. Topographic Survey Report
16. Geotechnical Investigation Report

Project Location Map



Perspective

List of Figures

List of Tables

Abbreviations

Abbreviation	English	Portuguese
ANE	National Roads Administration	Administração Nacional de Estradas
ASC	Customer Service Area	Area de Servico ao Cliente
B/A	Banking Agreement	
bps	bit per second(unit of data transfer rate)	
CAL	Labor Arbitration Center	Centro de Arbitragem Laboral
CDN	Northern Development Corridor	Corredor de Desenvolvimento do Norte
CFM	Mozambique Ports and Railways	Portos e Caminhos de Ferro de Moçambique
CREE	Commission for Foreign Economic Relations	
CT	Current Transformer	
DDC	Central Distribution Directorate	Direccao de Distribuicao Centro
DDM	Maputo Distribution Directorate	Direccao de Distribuicao Maputo
DDN	Northern Distribution Directorate	Direccao de Distribuicao Norte
DDS	Southern Distribution Directorate	Direccao de Distribuicao Sul
DPA	Provincial Directorate of Agriculture	Direcção Provincial de Agricultura
DPCA	Provincial Directorate for Co-ordination of Environmental Affairs	Provinciais para Coordenação da Acção Ambiental
DUAT	Right for use and benefit of land	Direito de Uso e Aproveitamento da Terra
E/N	Exchange of Note	
EDM	Mozambican Electricity Company (No official English Name)	Electricidade de Moçambique
EG	Emergency Generator	
EHS	Environment, Health and Safety	
EIA	Environmental Impact Assessment	
EIU	Economist Intelligence Unit	
ESCS	Environmental and Social Consideration Survey	
EWS	Engineering Work Station	
F/S	Feasibility study	
FOB	Free on Board	

Abbreviation	English	Portuguese
G/A	Grant Agreement	
GW	Gigawatt (=1,000,000kW)	
GNI	Gross National Income	
GWh	Gigawatt hour (=1,000,000kWh)	
HCB	Cahora Bassa Hydropower	Hidroelectrica de Cahora Bassa
IEC	International Electro-technical Commission	
IFC	International Finance Corporation	
IPP	Independent Power Producer	
JEC	Japanese Electromechanical Committee standard	
JICA	Japan International Cooperation Agency	
JIS	Japan Industry Standard	
kV	Kilovolt(1000 volt)	
kVA	kilovoltampere	
kW	kilowatt	
kWh	kilowatt hour	
LCD	Liquid Crystal Display	
MICOA	Ministry of Coordination of Environmental Affairs	Ministério para Coordenação de Acção Ambiental
MITADER	Ministry of Land, Environment & Rural Development	
MVA	megavoltampere	
MW	Megawatt(=1,000kW)	
MWh	Megawatt hour(=1,000kWh)	
MZN	Mozambican Metical	
NGO	Non-governmental Organization	
O&M	Operation and Maintenance	
ONAF	Oil Natural Air Forced	
ONAN	Oil Natural Air Natural	
PAP	Project Affected Person	
PARP	The Poverty Reduction Action Plan	
PC	Personal Computer	
PLC	Power Line Carrier	

Abbreviation	English	Portuguese
PM (SPM)	Particulate Matter (Suspended Particulate Matter)	
PSS/E	Power System Simulator for Engineering	
PT	Potential Transformer	
ROW	Right of Way	
RTU	Remote Terminal Unit	
RU	Relocation Unit	
SAIDI	System Average Interruption Duration Index	
SAIFI	System Average Interruption Frequency Index	
SCADA	Supervisory Control And Data Acquisition	
SCS	Substation Control & Protection System(SCS)	
SER	Simplified Environmental Impact Assessment Report	
SES	Simplified Environmental Impact Assessment Study	
SF6	Sulfur hexafluoride	
SLUCP	Simplified Land-use Compensation Plan	
SS	Substation	
SVC	Static Var Compensator	
TL	Transmission Line	
TOR	Terms of Reference	
UPS	Uninterruptible Power Supply	
VAT	Value Added Tax	
VT	Voltage Transformer	
WB	World Bank	

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Project

1) Present Conditions and Challenges

Mozambique's power demand rapidly has increased annually by 11.3% from 2005 to 2012. Its maximum power demand reaches 706 MW and the annual power supply energy amounts to 4,251 GWh as of 2012.

The critical issue in the power sector of Mozambique is the extremely low electrification rate at about 22% as of 2012 on a nation-wide average. The Northern and Central area remain at just 14%, and the Southern area reaches about 50% as of 2012. It is a problem that the Northern and Central area cannot provide sufficient electricity energy services.

The major power generation in Mozambique is the Cahora Bassa Hydro-power Plant ("HCB") with a capacity of 2,075 MW. However, much of the HCB power energy is transmitted directly to South Africa, while the Central and Northern grid are provided with very limited power from the HCB. This situation is likely to continue, and causes a severe power shortage against the growing power demand in the Northern and Central regions. While there is some expansion of new power generation in the Northern area, such as Lurio (120 MW) and Alto Malena (60 MW) of hydro-power generation which are just under the feasibility study, no specific power development project is under schedule at the current stage of the Northern grid. Although the mid- and long-term power development plan is steadily progressing, it is another crucial issue to enforce the existing transmission network and rehabilitate the conventional transmission facilities.

One of the major challenges in the Northern grid is the current situation of existing substations. The main problem is a lack of substations as well as the old and deteriorated substations that are more than 30 years old. Another trouble is the frequent occurrence of power outages, which happen once every two days, due to the overloading of the Nampula 220 substation that is the main power source in the Northern network. In addition to it, the power supply from Nampula to the Nacala district depends on the sole single transmission line, whereas the Nacala area has a rapidly growing power demand. This is another issue to ensure a stable power supply and secure power reliability for the Nacala corridor.

According to the power demand forecasting, the power load of the Nampula 220 substation with a 200 MVA capacity is anticipated at 353 MW in 2016 that exceeds approximately 100% of the operation capacity of this substation in consideration of power factor at 0.85.

Under these circumstances of the Northern grid, it is a truly crucial issue to reinforce the transmission network with the construction of new substations in order to assure a reliable power supply to the Nacala corridor area.

2) National and Regional Plan

In "The Poverty Reduction Action Plan (2011-2014)" ("PARP"), the Government of Mozambique (hereafter "GOM") considers that the lack of basic infrastructure, such as electric power services, is the major reason of poverty in rural farm villages and the urban fringe; therefore, improving the infrastructure in this area is very important. Also, this project is in line with the power sector master plan proposed in 2004, which includes constructing 400 kV new transmission lines and a new substation at the Namialo in the Northern grid.

The said power sector master plan of Mozambique, which was updated and approved by the EDM in 2014, estimates that the power demand of Mozambique will reach 3,696 MW, the power supply will reach 22,753 GWh by 2026, and the power demand will continually increase at an annual growth rate of 12.5% from 2011 to 2026. Specifically, the demand growth of the Northern grid is estimated at 13.5%, which is higher than the figures estimated for the Central grid (11%) and Southern grid (12.7%). It means that the Northern grid needs more rapid power development.

In order to meet this rapid power demand increase in the Northern area, the Master Plan recommends the following project plans:

- Chimuara-Nacala transmission project (Chimuara-Alto Molocue-Namialo)
- 220kV transmission enforcement project (Nampula-Namialo-Evate-Nacala Velha and Namialo-Metoro)
- Construction of the new substations along these new transmission lines

The new Namialo substation of this project will be connected to 400 kV and 220 kV lines in the future and becomes one of the most important substations in the Northern grid.

Furthermore, the master plan estimates that the electrification ratio will reach 25% in 2016 with the expectation of annual connections to electricity services from 80,000~100,000 households that consequently improves the electrification ratio by 6 points from 2011 to 2016, ultimately expecting the electrification ratio to rise to 35% in 2027 at the best case scenario.

In order to achieve these targets for electrification, some projects such as the voltage upgrade of the distribution network from 11 kV to 33 kV, reinforcement of the distribution network, and construction of new substations are planned.

1-2 Natural Conditions

(1) Climate

The project site is in the northern region of Mozambique with a subtropical climate with two seasons: a rainy season from November to April and a dry season from May to October. Average annual precipitation of Nampula city (the city nearest to the project site) is about 1,100 mm.

According to the hearing from neighborhood, the project site area has had no disasters from flooding in the last decade.

(2) Topography and Geology

Local consultants carried out a topographic survey and geotechnical investigation of the project site including the access route from national highway (EN12) for this preparatory survey.

The altitude of the project site is about 190 m and the site is almost flat with a very gradual slope from EN12 to the site (the elevation difference is only about 2 m in 1.5 km).

For the geotechnical investigation, the following works were executed:

- 3 nos. of borehole up to 15m depth
  (1 point at the center of Namialo substation, and 2 points at new transmission towers)
- SPT (standard penetration test)
- Collection of soil samples and laboratory tests
- Soil resistivity test

As a result of the geotechnical investigation, it was found that the ground of the project site is firm and the allowable bearing capacity is 200 kPa. No pile foundation is required, and all foundations and buildings can be designed with direct foundations.

Furthermore, according to the hearing from the neighborhood, the project site area is well drained and not submerged during the rainy season.

The Topographic Survey Report and Geotechnical Survey Report are attached as Appendix-15 and 16 respectively.

(3) Mines

During last civil war in Mozambique, mines were laid in various places. Therefore, the possibility of mines in the project site was surveyed. According to the National Institute of Demining, it was officially announced that the Nampula province is free from mines as of 2010. The EDM also ensures that the project site is free from mines since most of the project site belongs to the ROW of existing 110 kV transmission lines that are periodically mowed for maintenance purposes.

1-3 Power Demand Forecast and Power Development Plan

(1) Power Demand Forecast

Power demand forecast in Mozambique is shown in Table 1-1 below. Mozambique's power demand rapidly increased annually by 12.4% from 2011 to 2026. Its maximum power demand will reach 3,696MW in 2026.

Particularly, the power demand of the Nacala area is estimated to steeply grow at an annual rate of 20.7%, which is the highest rate in the country. Much of this demand is deemed to come from the power demand expectations of the new Nacala harbor, airport and industrial factories.

Table 1-1 Power Demand forecast

Medium Load Forecast by Customer Service area			MW				
Region	Province	Customer Service Area	2011	2016	2021	2026	AAG*
South DDS	Inhambane	ASC Inhambane	14	18	23	30	5.3%
	Gaza	ASC Xai-Xai	18	102	163	173	16.1%
		ASC Chokwe	32	102	110	119	9.1%
	Maputo	ASC Maputo Province	124	247	308	1,311	17.0%
DDM	City of Maputo	City of Maputo	201	404	543	675	8.4%
Center DDC	Sofala	ASC Beira	72	291	391	429	12.6%
	Manica	ASC Chimoio	27	46	57	71	6.5%
	Tete	ASC Tete	29	199	126	129	10.6%
	Zambezia	ASC Mocuba	9	24	27	40	10.1%
		ASC Quelomane	16	50	66	74	10.9%
North DDN	Nampula	ASC Nampula	48	88	140	160	8.3%
		ACS Nacala	22	210	356	369	20.7%
	Cabo Delgado	ASC Pemba	17	55	77	87	11.4%
	Niassa	ASC Lichinga	9	15	21	29	8.0%
		Total	638	1,851	2,408	3,696	12.4%

*) Annual Average Growth

[Source: Master Plan Update Project, 2012-2027 Volume II –Load Forecast Report]

(2) Current Power Generation Resource

Table 1-2 below shows the current power generation capacity, as of 2013. Maximum demand of 2013 is 709 MW while the domestic power supply is 614 MW. Deficiency power of 95 MW is imported from South Africa. Cahora Bassa Hydropower has a capacity of 2,000MW; however, allocation to the EDM is limited to 500MW. The current power source in the Northern grid depends solely on the Cahora Bassa Hydropower plant with a long-distance transmission line.

Power generation is shared with the HCB (91%), EDM's own generation (6%), imports (2%), and the IPP (1%).

Table 1-2 Power Generation Capacity as of 2013

Generation Capacity [MW]	Total in Mozambique	Available for EDM	Export	Import
Hydro Power generation				
Corumana	8	8		
Mavuzi	25	25		
Chicamba	34	34		
Cahora Bassa S for EDM	500	500		
Cahora Bassa S Export	1,500		1,500	
Thermal Power generation				
Aggreko 1 & 2 for EDM	15 + 32	15 + 32		
Aggreko 1 & 2 for Export	85 + 90		85 + 90	
Total Generation [MW]	2,289	614	1,675	
EDM Peak Load (June 2013)	709	614		95

[Source: Master Plan Update Project, 2012-2027 Volume III – Main Report]

(3) Power Generation Construction Plan

Hydropower and thermal power generation development are shown in Table 1-3 and Table 1-4 below.

Power generation construction is divided into EDM-owned and IPP. Some portions of IPP-generated power are provided directly to a few large customers. This causes a shortage of power, although projects for new power generation are planned. This shortage of power should be compensated by importing power from South Africa.

For example, the power demand for 2016 is estimated at 1,851 MW, while the total power supply from hydro- and thermal-power plants to the EDM grid is only 1,221 MW. This power shortage of 630 MW needs to be covered by importing power from South Africa.

Table 1-3 Hydropower Generation Development Plan and Power Allocation to EDM

	Installed Capacity	Short Term				Medium Term Options					Long Term Options				
	[MW]	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Corumana	17	8	8	16	16	16	16	16	16	16	16	16	16	16	16
Mavuzi	52	25	25	25	42	42	42	42	42	42	42	42	42	42	42
Chicamba	44	34	0	0	44	44	44	44	44	44	44	44	44	44	44
Cahora Basa South	2,000	500	500	715	715	715	715	715	715	715	715	715	715	715	715
Alto Malema	60							60	60	60	60	60	60	60	60
Mphanda Nkuwa	1,500										300	300	300	300	300
Lupata	600										250	250	250	250	250
Massingir	40										27	27	27	27	27
Moamba Major	15										15	15	15	15	15
Muenezi	21													21	21
Tsate	50											50	50	50	50
Boroma	200												200	200	200
Lurio 1, 2, 3	120													120	120
Cahora Bassa North bank	1,245														249
Supply for EDM		567	533	756	817	817	817	877	877	877	1469	1519	1719	1860	2109

[Source: Master Plan Update Project, 2012-2027 Volume IV –Summary Report]

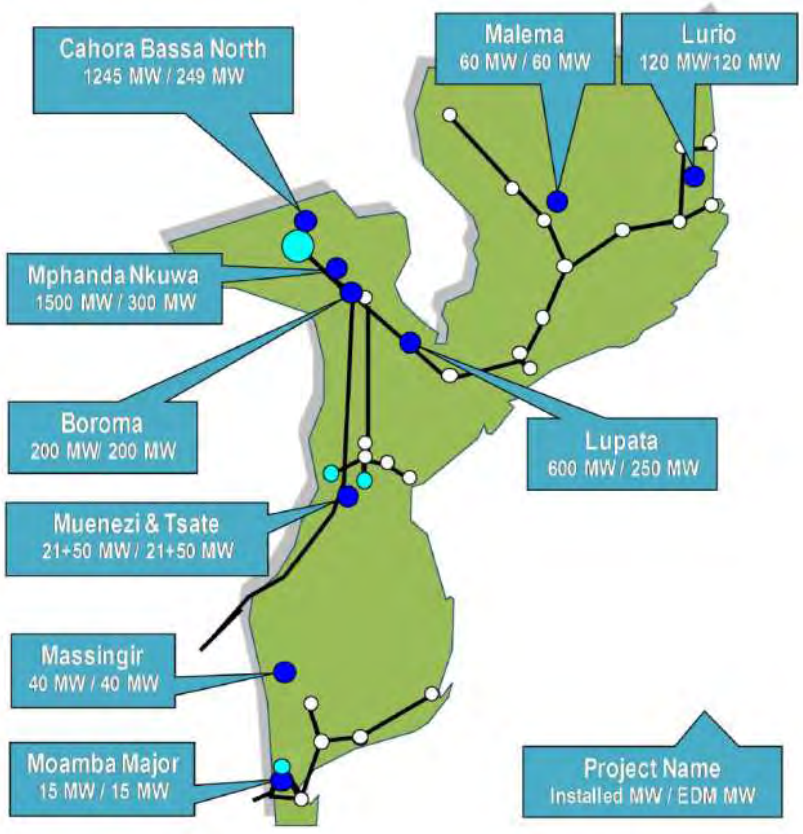
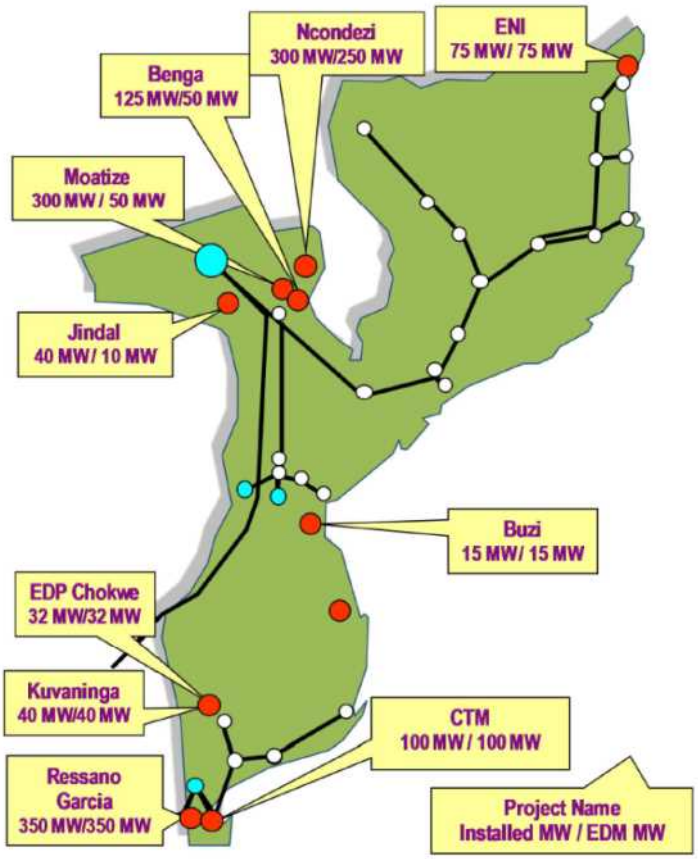


Figure 1-1 Hydropower Plant Location to be planned

Table 1-4 Thermal Power Generation Development Plan and Power Allocation to EDM

	Installed Capacity	Short Term				Medium Term Options					Long Term Options				
	[MW]	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Aggreko	100	15	15												
Aggreko2	122	32	32	32											
CTRG	175		150	150	150	150	150	150	150	150	150	150	150	150	150
CTM	100			47	47	100	100	100	100	100	100	100	100	100	100
EDP Chokwe	32			32	32	32	32	32	32	32	32	32	32	32	32
Electro Tec	100					100	100	100	100	100	100	100	100	100	100
Gigawatt	100				100	100	100	100	100	100	100	100	100	100	100
Moatize 1	300				50	50	50	50	50	50	50	50	50	50	50
Jindal 1	40				10	10	10	10	10	10	10	10	10	10	10
Buzi	15				15	15	15	15	15	15	15	15	15	15	15
Kuvaninga	40					40	40	40	40	40	40	40	40	40	40
Ncondezi1	300					250	250	250	250	250	250	250	250	250	250
Benga1	125						50	50	50	50	50	50	50	50	50
ENI	75						75	75	75	75	75	75	75	75	75
Supply for EDM		47	197	261	404	847	972	972	972	972	972	972	972	972	972

[Source: Master Plan Update Project, 2012-2027 Volume IV –Summary Report



[Source: Master Plan Update Project, 2012-2027 Volume IV –Summary Report]

Figure 1-2 Thermal Power Plant Location to be planned

(4) Transmission System Expansion Plan

Plans for the expansion of a transmission system in the Northern region are shown in Table 1-5 below.

In order to meet rapid power demand growth in the Northern region, the construction of a 400 kV transmission line and other projects are planned, and many transmission system reinforcements are focused in Nacala and the surrounding area.

Table 1-5 Transmission system expansion plan in the Northern region

Commissioning Year (Target year)	Project Name
2015	1) 220kV line Caia – Nampula: Series compensation of the existing line
2016	1) SVC in Nampula Substation 2) 110kV Line Cuamba – Marrupa 3) New Marrupa Substation 4) 110kV Line Metoro – Pemba 5) 220kV Line Namialo – Metoro 6) 400kV Line Chimuara – Namialo
2017	1) 220kV Line Nampula – Nacala
2018	1) 110kV Line Nampula – Moma

[Source: Master Plan Update Project, 2012-2027]

(5) Current Situation of the Northern Grid

The Current Situation of the Northern Grid is analyzed based on PSS/E data of peak demand as of 2014, which was provided by the EDM. Substations and transmission line length in the Northern grid are shown in Figure 1-3. As mentioned above, the Northern grid is supplied from the Cahora Bassa Hydropower plant through 220 kV and 110 kV transmission lines. The longest distance of power transmission is about 1,500km from the Cahora Bassa to Auasse substation located in the northeast area.

This system condition requires a lot of reactive power compensators and SVC equipment in order to reduce the voltage drop and decrease the effect of voltage fluctuation.

It is recognized that the series capacitor compensation to transmission line is introduced to improve the power transfer capacity over such a long distance line.

The power demand of the Northern system as of 2014 and the transmission capacity in the Northern grid are shown in Figure 1-4 and Figure 1-5, respectively. It is confirmed that no over loads occurred in 2014. Nampula substation has a transformer capacity of 200 MVA, which is the power source

substation in the Northern region; its total demand is 142 MVA, the demand of Nampula, Pemba, and Nacala areas.

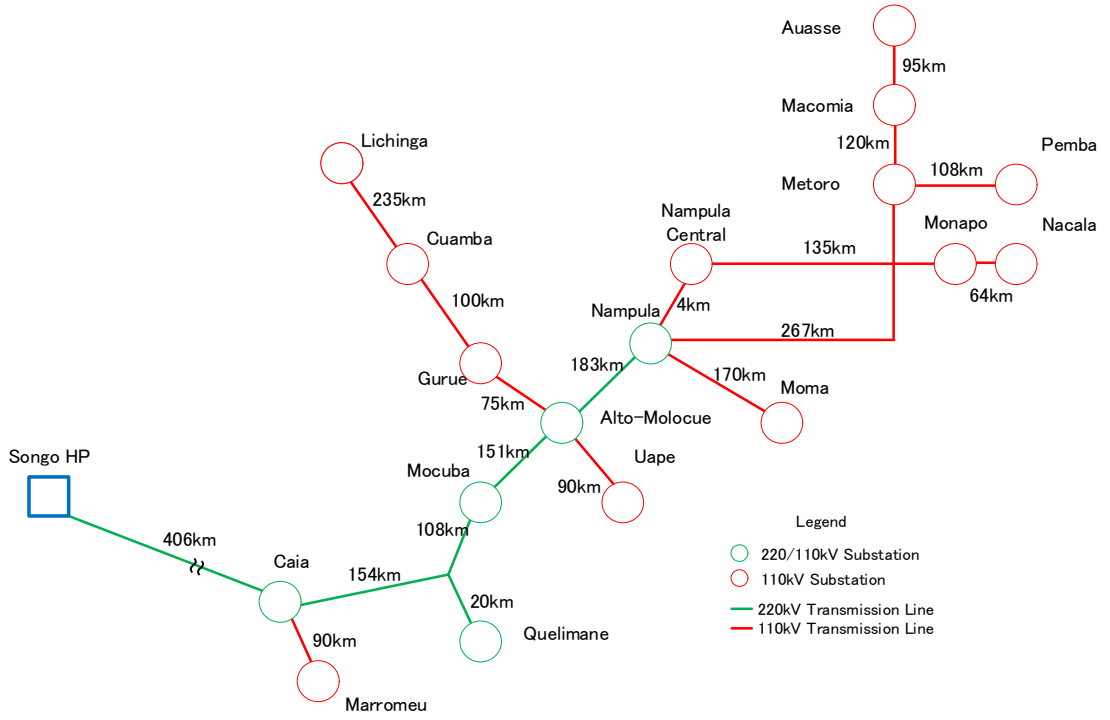


Figure 1-3 Current Condition of Substations and transmission line length in the Northern grid

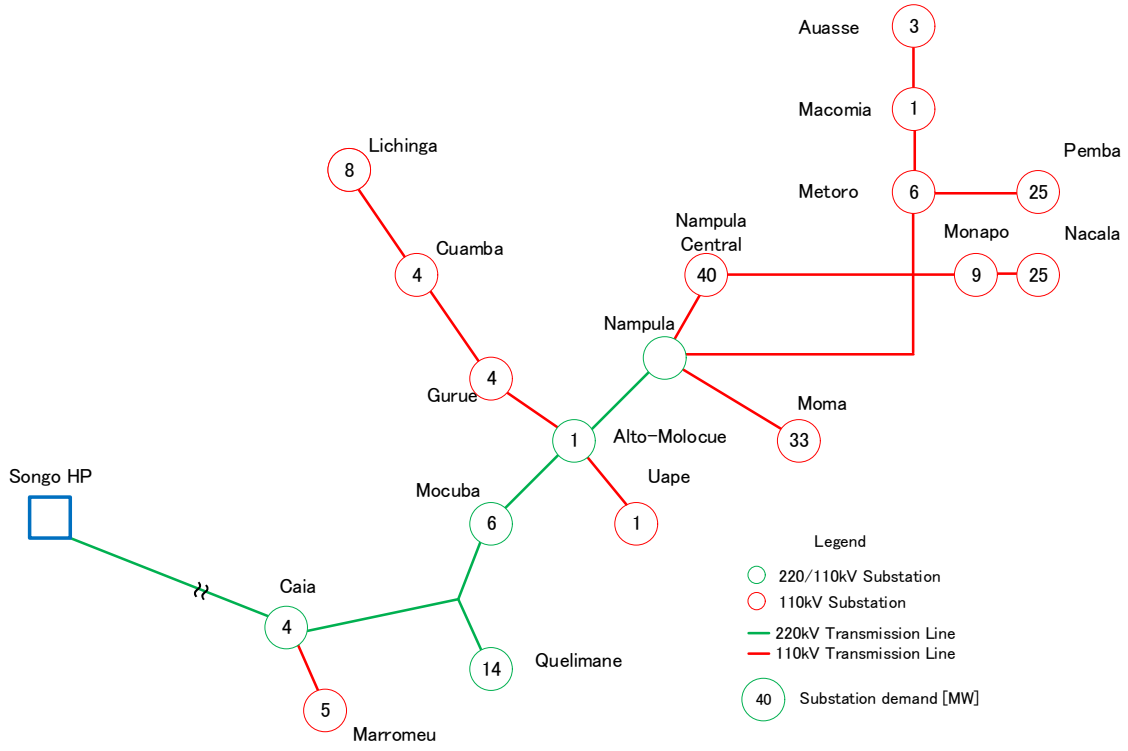


Figure 1-4 Power demand of the Northern system as of 2014

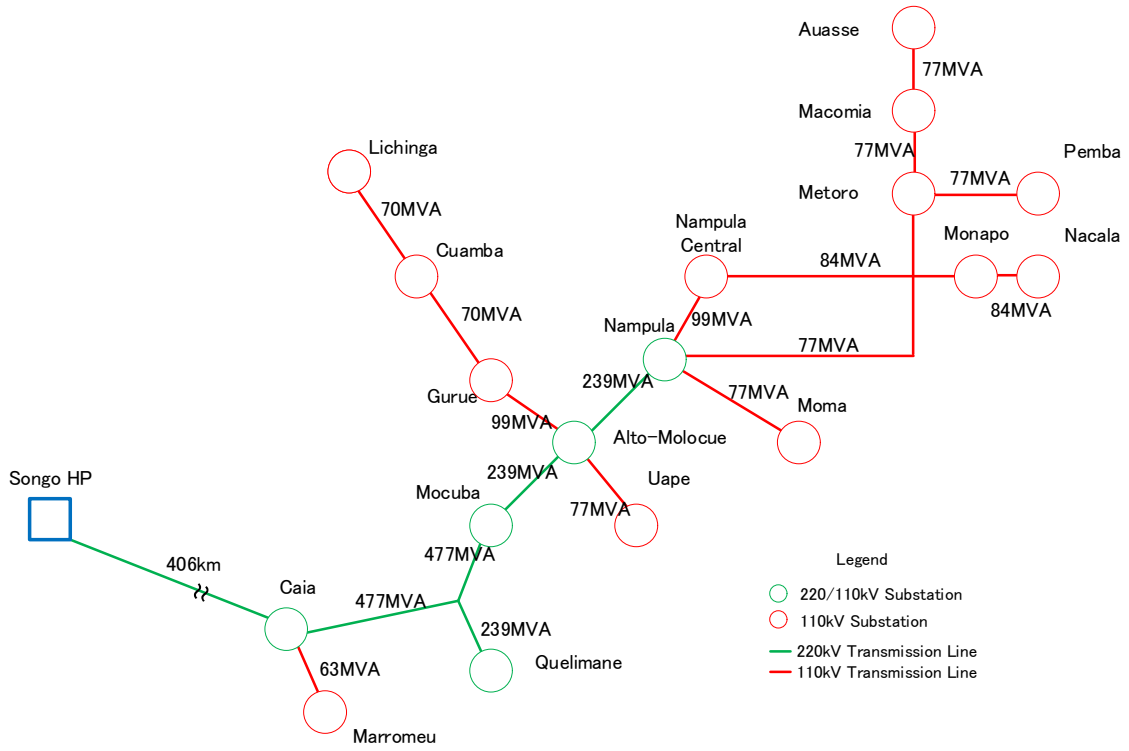


Figure 1-5 Transmission Capacity in the Northern grid

Figure 1-6 below shows the voltage phase shift on the basis of the Cahora Bassa Plant as reference voltage. This shows that the voltage phase difference in bus voltage of the Pemba substation goes up to 86 degrees which means that the Northern grid may reach the transfer angle limit of 90 degrees, at which point the power system falls into system collapse. It is clarified that the new power generation and transmission lines are the most critical issue for the Northern grid to meet the continually growing power demand in this region.

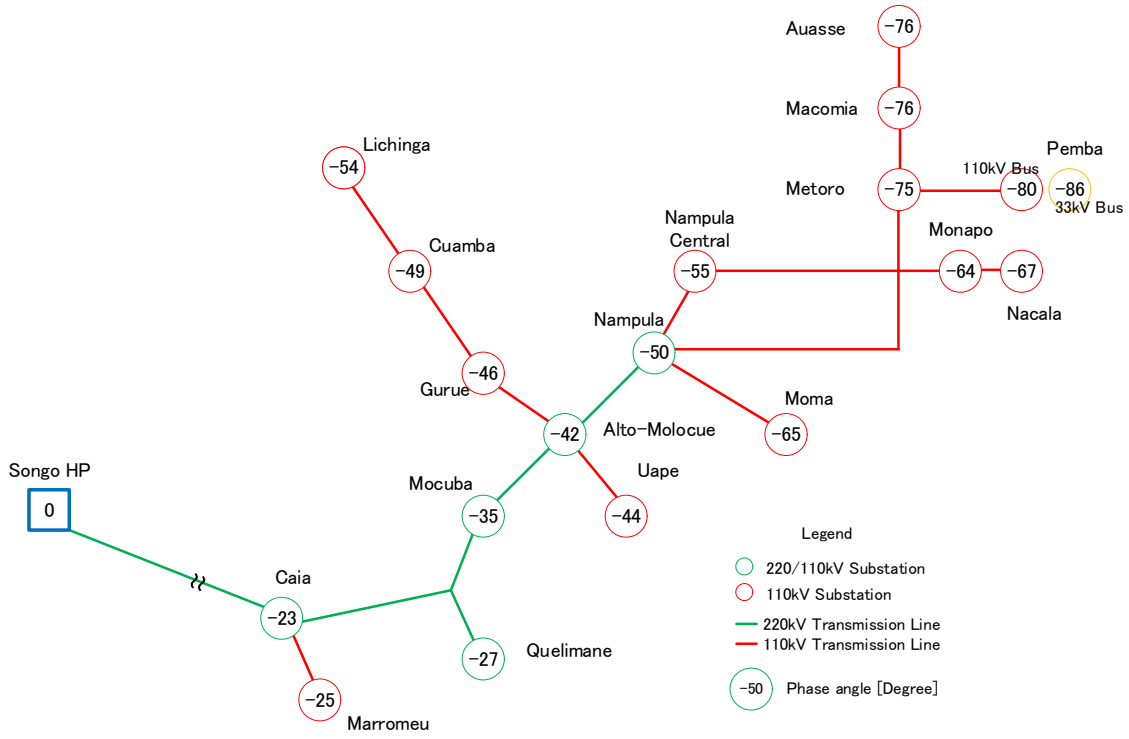


Figure 1-6 Voltage Phase Angle referring to the Cahora Bassa Plant

(6) Power Demand Forecast in Northern Region

The Power Demand Forecast in the Northern Region is shown in Table 1-6 and the Large Customer Power Demand (such as factories) shown in Table 1-7. It is recognized that much of the demand increase is due to new large customers, who are also responsible for much of the power demand increase of the Nacala substation. Therefore, it is very important to ensure a stable power supply for the economic development in the Nacala area.

The Northern Region power demand will grow to 363 MW in 2016 and power demand supplied by the Nampula substation will come to 353 MW. This demand exceeds the capacity of 200 MW of the Nampula substation. If the transmission enforcement recommended by the Master Plan is not executed according to an appropriate schedule, the Northern grid will not be able to manage a sufficient power supply and meet the power demand of this dramatically increasing area.

Table 1-6 Power Demand Forecast in the Northern Region

Medium Load Forecast by		MW			
Area Distr.	Substation	2011	2016	2021	2026
Nampula	Moma	16	35	68	69
	Nampula central	32	53	72	91

Nacala	Monapo	7	94	157	161
	Nacala	15	116	199	208
Pemba	Auasse	1	7	7	8
	Macomia	2	2	3	4
	Metoro	4	11	13	15
	Pemba	11	35	55	61
Lichinga	Cuamaba	3	3	5	6
	Lichinga	6	8	10	13
	Marrua	0	4	6	10
Total		97	368	595	646

[Source: Master Plan Update Project, 2012-2027 Volume II –Load Forecast Report]

Table 1-7 Large Customer Power Demand Forecast such as factories in Northern Region

Medium Load Forecast by		MW			
Area Distr.	Substation	2011	2016	2021	2026
Nampula	Moma	15	32	65	65
	Nampula central		8	8	8
Nacala	Monapo		85	145	145
	Nacala		95	170	170
Pemba	Auasse		5	5	5
	Macomia				
	Metoro		15	15	15
	Pemba		10	18	18
Lichinga	Cuamaba				
	Lichinga				
	Marrua				
Total		15	250	426	426

[Source: Master Plan Update Project, 2012-2027 Volume II –Load Forecast Report]

(7) Power System Analysis during the commission year of the Namialo Substation

The new Namialo substation is planned to be commissioned in 2017. Providing that new transmission reinforcements are installed by then, and using power demand data as of 2018, a system analysis was carried out. New power facilities are listed in Table 1-8 which are planned to be installed by the commission of the Namialo substation. Figure 1-7 shows the configuration of the Northern grid at that time. System analysis is performed based on PSS/E data received from the EDM using power demand and technical data from power facility enforcement.

Since the demand forecast of the Namialo substation is not specified in the Master plan, it is assumed that the Namialo substation takes 70% of the demand of the Monapo substation and some part of large customers.

Analysis results of power demand and power flow is shown in Figure 1-8, and the result of power demand and voltage profiles are shown in Figure 1-9. Furthermore, Figure 1-10 shows the voltage phase shift on the basis of the Cahora Bassa Plant as a reference voltage.

As a result, it is clarified that transmission line from Namialo to Monapo is overloaded and it is needed to enforce additional new line to meet the increasing demand. No overload occurs in any other transmission lines, and substations. The voltage profile also appears to be within an acceptable range of 0.95-1.05 P.U. The voltage angle has no technical problems, either.

It is understood that the new Namialo substation with 110 kV equipments will become one of the most important substations in the Northern grid because new 220 kV and 400 kV transmission lines will be connected to the substation. In particular, the Nampula Central substation will have double power source lines, one from Nampula 220, the other from Namialo. This means that if one transmission line fails, the other line can supply power to Nampula Central. In the same way, Nampula 220, Monapo and the Nacala substation can attain a more reliable power network by connecting to the Namialo substation through 110 kV and 220 kV lines without an outage in case of a single line failure.

Table 1-8 Assumption of Power Facilities to be installed by the commission date of the Namialo Substation

Facility	Project Name
Power Plant	ENI Thermal Power Station Ncondezi Thermal Power Station Benga Thermal Power Station Moatize Thermal Power Station
Transmission	110kV Line Cuamba – Marrupa 110kV Line Metoro – Pemba 220kV Line Namialo – Metoro 220kV Line Nampula – Nacala 400kV Line Chimuara – Namialo 400kV Line Chimuara – Ncondenzi
Substation	Namialo Substation Marrupa Substation

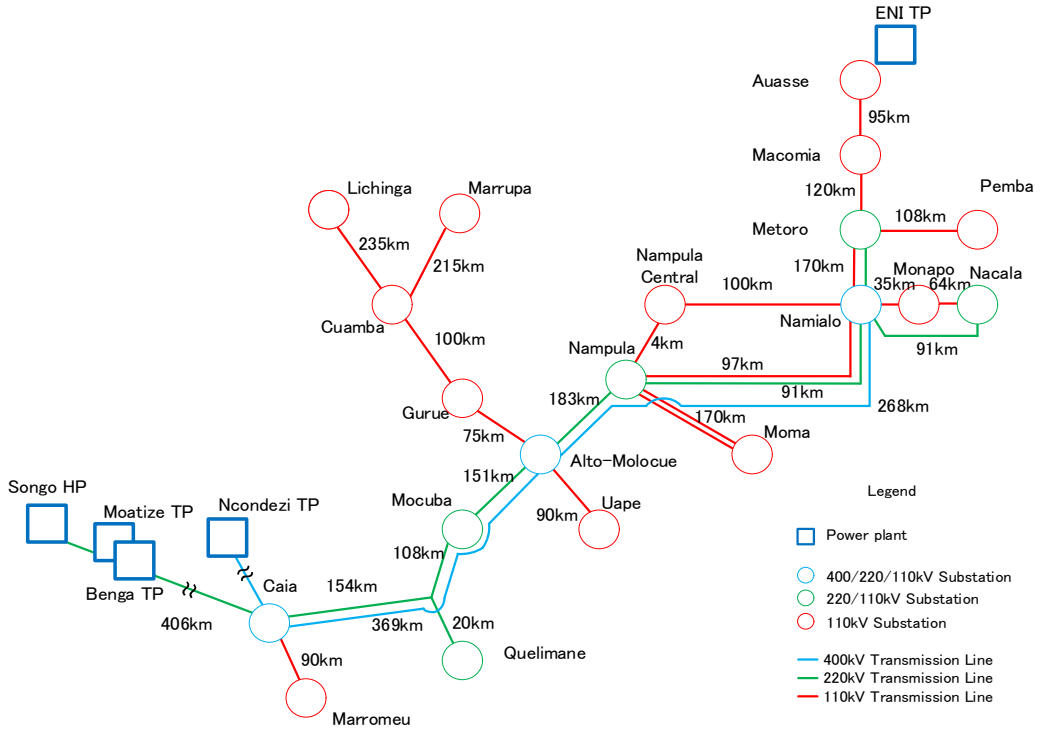


Figure 1-7 Future Northern Grid at the commission year of the Namialo substation

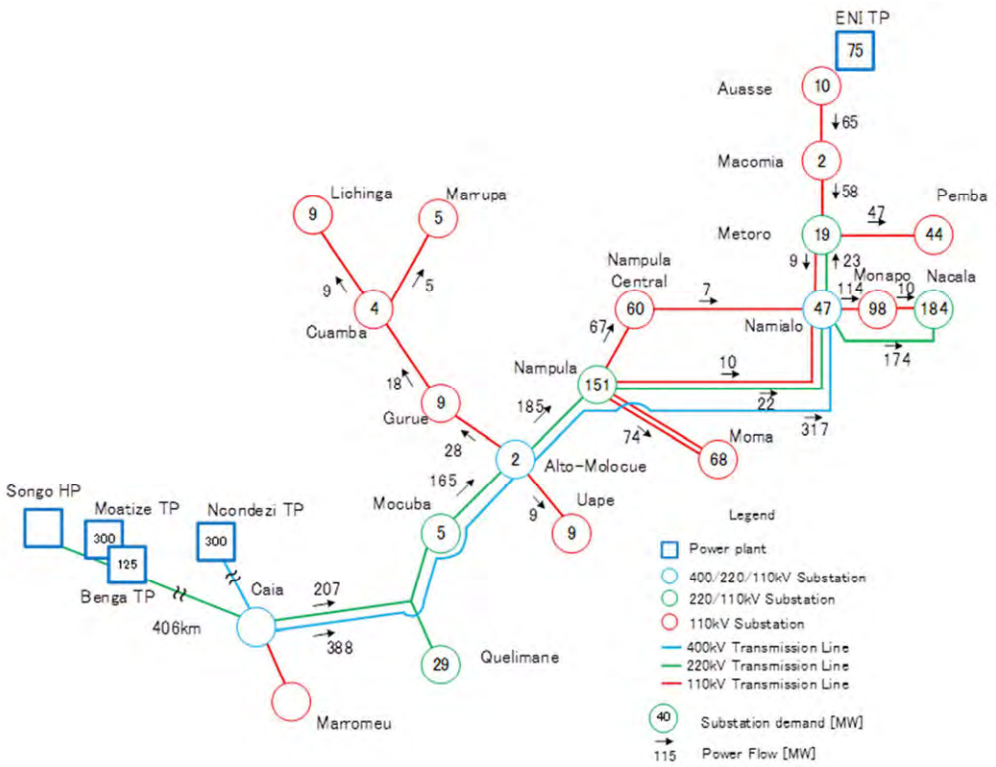


Figure 1-8 Power Demand and Power Flow at the commission year of the Namialo substation

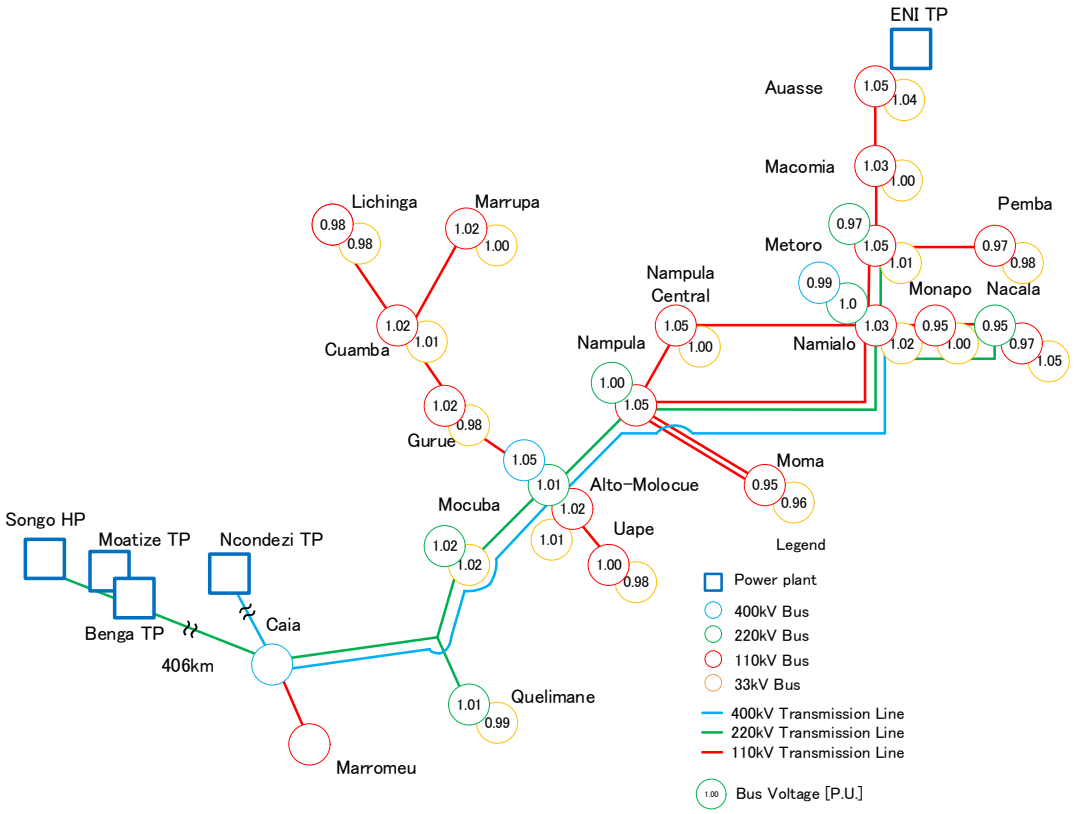


Figure 1-9 Voltage Profile at the commission year of the Namialo substation

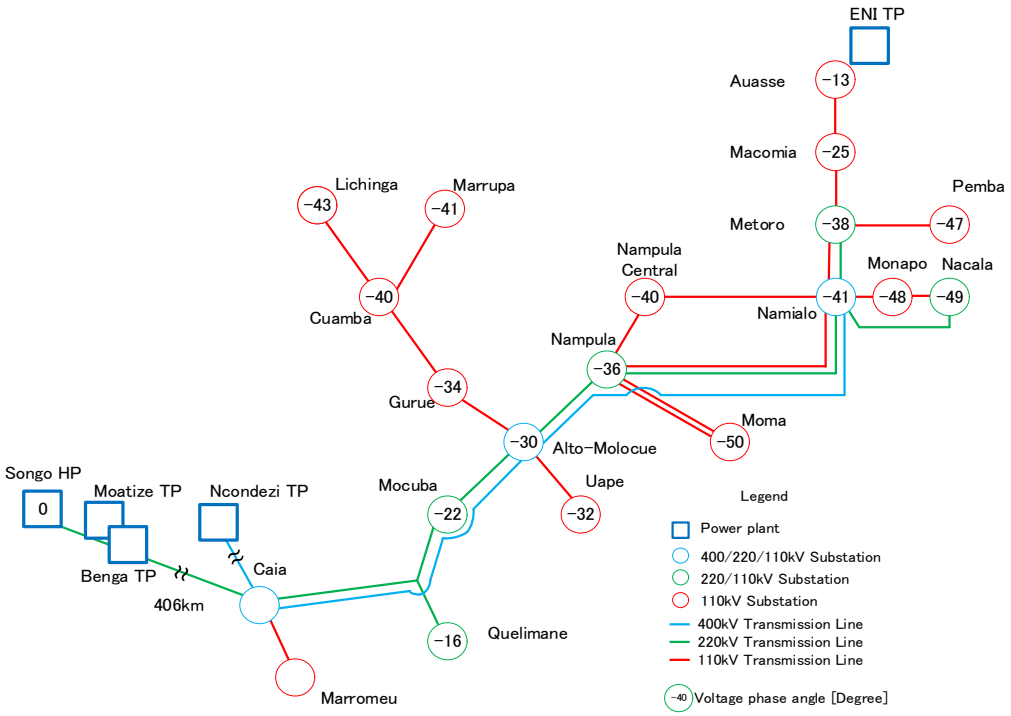


Figure 1-10 Voltage Phase Angle at the commission year of the Namialo substation

(8) Short Circuit Current of the Northern Grid

The Short Circuit Current at the commission year of the Namialo substation is shown Figure 1-11. It is noticed that there are no problems at this time. Figure 1-12 shows the short circuit current according to the long-term plan described in the Master Plan. The results show that the maximum short circuit current attains 13kA and this figure is considered not to be a hazardous value.

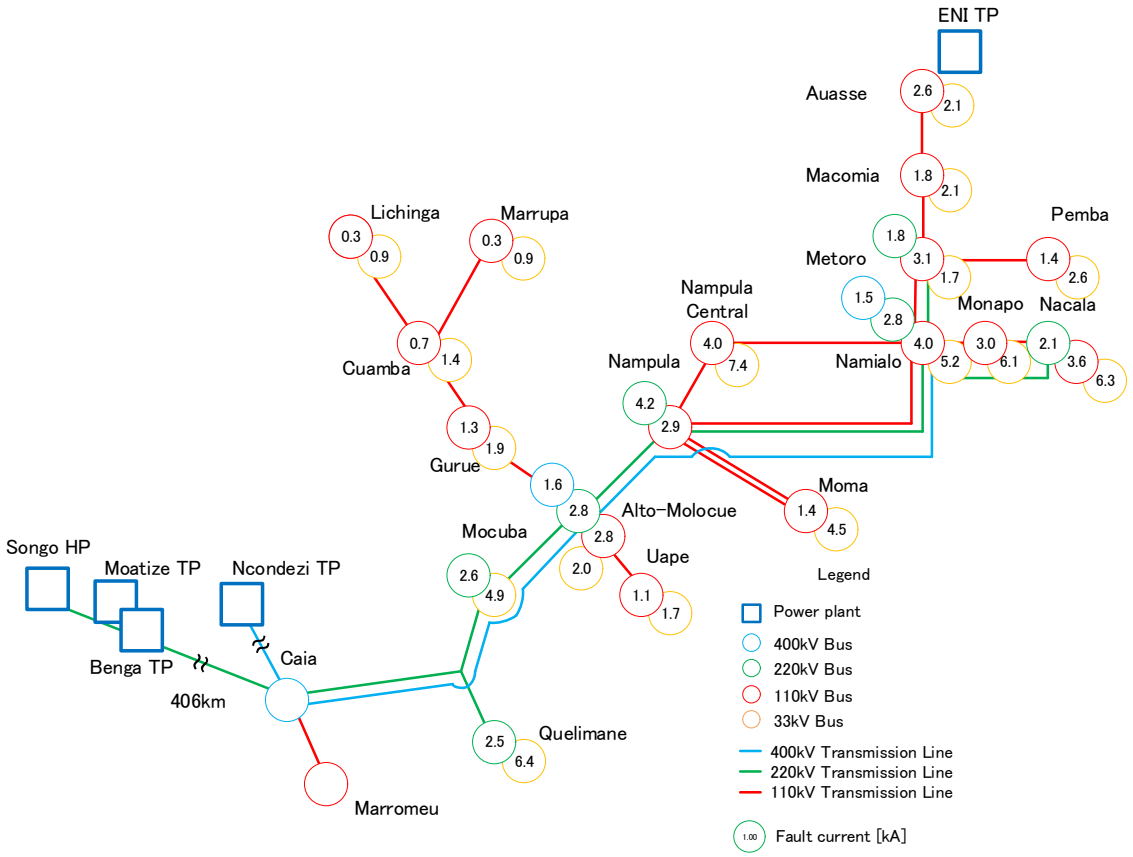
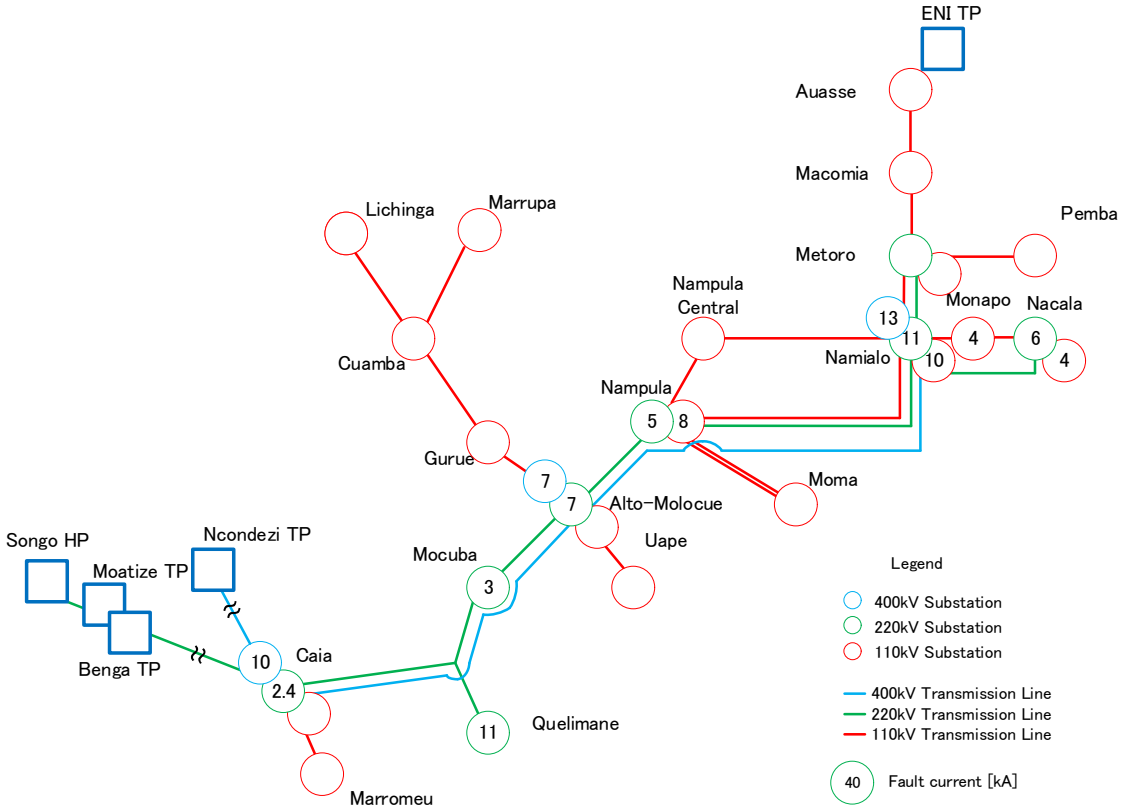


Figure 1-11 Short Circuit Current at the commission year of the Namialo substation



[Source: Master Plan Update Project, 2012-2027 Volume III – Main Report]

Figure 1-12 Short Circuit Current based on the long-term transmission system plan

(9) Necessity of the Namialo Substation

The Namialo substation is expected to take the load of the Monapo substation after its commissioning; however, there is no description about the load of the Namialo substation in the Master plan. According to the result of the hearing with the Monapo substation operators at the site visit, the power supply to the Namialo area is currently from the Monapo substation and peak demand of its substation is 9 MW in 2014 and the power factor is 0.85. This figure is coincident with the PSS/E data provided from the EDM.

On the other hand, the Master plan forecast shown in Table 1-9 estimates the relative conservative scenario with a general customer demand of 7MW in 2011 and 9MW in 2016.

On account of this difference, actual demand growth is deemed to be greater than the Master plan estimation.

Therefore, the Master plan demand forecast will be corrected based on the actual demand record with the assumption of power factor being 0.85 as shown in Table 1-10. The power demand as of 2011 and 2014 is corrected to 8MVA and 11MVA respectively, and the power growth rate comes to

11% per year. Consequently, the power demand of Monapo substation at 2018 is estimated at 17MVA when the Namialo substation is due to be commissioned.

It is concluded that the load of the Monapo substation exceeds its capacity of 16 MVA and the Namialo substation is necessary to resolve the overload of the Monapo substation by reinforcing the distribution power supply and contributing to meet the increasing demand in the Northern region.

Table 1-9 Detailed Power Demand Forecast of the Monapo Substation

[Medium case]		Demand [MW]			
		2011 year	2016 year	2021 year	2026 year
Large consumer	A	--	60	105	105
	B	--	25	40	40
General consumer		7	9	12	16
Total Demand		7	94	157	161

[Source: Master Plan Update Project, 2012-2027 Volume II –Load Forecast Report]

Table 1-10 Load Forecast of the Monapo Substation on the basis of actual record

[Medium case]	Load [MVA]			
	2011 year	2014 year	2018 year	2020 year
Actual Load Estimation	8	11	17	20

After the Namialo substation is constructed and commissioned, the Nampula Central substaion will receive the power from the Nampula 220 and Namialo substations, and also a 110kV transmission line from the Nampula 220 substation to Namialo substation will be duplicated. It improves the reliability of power supply to Nacala and Pemba areas.

On the other hand, the voltage phase problem of Pemba and voltage drop problem of Nacala still remain after the completion of the Namialo substation. These problems can be solved by the Chimuara-Nacala transmission project consisting of the construction of new 400kV transmission line from Chimuara to Namialo and 220kV transmission line from Nampula to Nacala. When the Chimuara-Nacala transmission project is completed, the Namialo substation will become one of the most important substations with additional 400kV/220kV/110kV substation equipment, and it will contribute to solve the overall technical problems in the Nacala corridor area.

1-4 Environmental and Social Considerations

1-4-1 Environmental Impact Assessment

1-4-1-1 Outline of the Project and Relevant Environmental Aspects

The project area of both the planned new substation and its access road is located along the ROW (Right-of-Way) of the existing transmission line of the EDM, and the project is of a rather small scale. As such, this project was classified as Category B per the JICA environmental and social consideration guidelines. Furthermore, as a part of a much larger scale Feasibility Study for Chimuara-Nacala 220 kV/400 kV Transmission Project completed by NORCONSULT in 2013, a similar substation in Namialo near this project area was planned. Moreover, the EIA study for this Chimura-Nacala Transmission project was approved by the MICOA[1] (Ministry of Coordination of Environmental Affairs) in December 2013.

As such, MICOA, based on the result of a site confirmation conducted by the DPCA-Nampula (Nampula Provincial Directorate for Coordination of Environmental Affairs), determined that this project falls under the same area of influence of the above already approved EIA study for the Chimuara-Nacala Transmission Project, and no further environmental clearance is necessary. This decision was officially communicated by the MICOA to the EDM in June 2014 (Letter No.826/MICOA/DNAIA/180/14 dated 12 June 2014 in Appendix-5).

Nevertheless, in compliance with JICA guidelines for Category B projects, the ESCS (environmental and social consideration survey) study composed of SES (Simplified Environmental Study/simplified environmental impact assessment study) and the SLUCP (Simplified Land-use Compensation Plan as social environmental study to compensate adverse social effects) was conducted under a subcontract. The study technically conformed to the Category B project aspects of Mozambique as well. The relevant environmental and social aspects as identified by these studies including baseline environmental and social conditions in the project site area are described below, conforming to the JICA Guidelines on Category B projects.

Figure 1-13 Project Site

[1] Since January 2015, MICOA has been integrated into the new ministry, MITADEL (Ministry of Land, Environment & Rural Development). However, the name MICOA is used in this report since the contents of this report is based facts prior to MITADEL being established.

1-4-1-2 Baseline Environmental and Social Conditions

(1) Environmental aspects

The project area is located in a sparsely populated village area (the locality of Micolene in Namialo) but still in an area with a high anthropogenic/human influence. The project area located along the existing transmission line is basically composed of small-scale subsistence agricultural farmsteads and fruit trees such as banana, cashew, mango, and others, with no housing (human settlements) in and around the immediate vicinity of the project area. There exists no rare/protected/endangered fauna or flora in and around the project area. Moreover, there are no culturally or archeologically significant areas located in and around the project area.

Northern Mozambique, the location of the project area in Namialo, is part of a humid equatorial climate with a dry winter season. Two distinct climate seasons are experienced: one is a wet and hot summer from November to April; the other is a cooler and dry winter from May to October. Mean annual rainfall in Nampula is about 1100 mm with most rainfall occurring in the summer. The mean monthly temperature varies from 19.40 C to 29.30 C. Based on interviews with residents, the project site in Namialo did not experience any serious flooding in the last 10 years and in fact is very often affected by droughts.

Furthermore, the groundwater quality of a dug-well of about 5 m deep located in the vicinity of the project area was analyzed for typical potable water quality parameters. The analytical results indicated that the water quality is very good for direct potable use (Refer to Table 1-16)

(2) Social aspects

The rural community surrounding the project area belongs to the locality of Micolene and the majority of the community belongs to the ethnicity of Makhuna. They are not very proficient in Portuguese (the official language of Mozambique); the common language spoken is Emakhuna. Most residents obtain their income from natural rain-fed agriculture that is basically small-scale and subsistence oriented with self-manual labor. Major crops cultivated are corn, cassava, beans, and nuts. Any surplus agricultural produce is sold to meet other living expenses.

The housing in the area is very basic in nature and was constructed using traditional materials and methods with walls made of a combination of wood, clay, and adobe with a roof made of straw or zinc. In general, these houses have no utility services like plumbing (a piped water supply) or electricity. Their water sources are communal wells/boreholes and others like ponds and small rivers or creeks.

1-4-1-3 Legal Framework for Environmental Impact Assessment in Mozambique

The 2004 Constitution of the Republic of Mozambique (CRM) defines the right of all citizens to live in a balanced natural environment, and their obligation to protect it. Furthermore, the State is

required to (i) promote initiatives capable of ensuring the ecological balance and the preservation of the environment; and (ii) implement policies to prevent and control pollution and to integrate environmental objectives in all public sector policies so as to guarantee the citizens' right to live in a balanced environment under a sustainable development framework.

The National Environmental Policy (No. 5/95), of December 1995, lays the foundation for all environmental legislations. Article 2.1 of this Policy promotes sustainable development through a compromise between the country's socio-economic development needs and the protection of the environment. This policy promotes, among others, the management of the country's natural resources, and of the environment in general, such that resources preserve their functional and productive capacities for both present and future generations. The Environment Law (Law No. 20/97, of 1 October 1997) defines the legal basis for the implementation of this Policy. The Law applies to all public and private activities that may directly or indirectly affect the environment.

The EIA process in Mozambique is well-developed and governed by the Environmental Impact Assessment Regulations under the Environmental Law of Decree No. 45/2004 and amended by Decree No. 42/2008. These Regulations are applicable to all public and private sector activities.

Articles 3 and 5 of the EIA Decree provide for a screening process that defines the extent and type of the environmental assessment required. Three project categories are defined by the Regulations as A, B, and C based on the anticipated degree of impact and the related EIA study requirement varies accordingly, as summarized below in Table 1-11. Annex I of the Decree also lists the type of projects for each category.

Table 1-11 Environmental category based EIA requirement of Mozambique

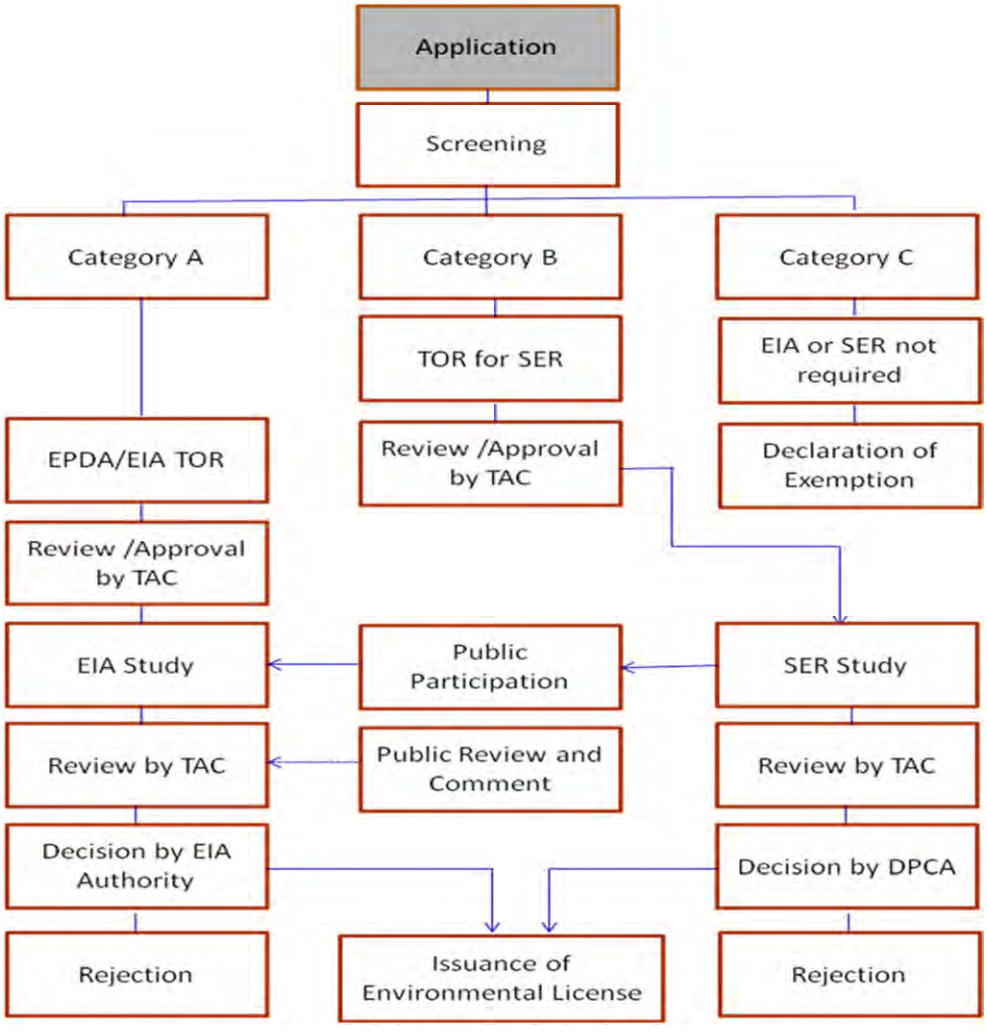
Category	Impact	Requirement
Category A	Significant and irreversible impact is predicted by the project implementation	Environmental Impact Assessment (EIA) and at least one public consultation are required
Category B	The adverse impact is predicted but the impact level may not be significant compared to Category A.	Simplified Environmental Impact Assessment Report (SER) is required. In case of resettlement of people is involved then the project is required to hold at least one public consultation
Category C	The adverse impact is predicted to be low or none	No particular requirement. However the appropriate environmental management including the monitoring implementation is required

MICOA, in coordination with the relevant provincial entities (DPCA), is the responsible agency for making the decision on the project category and the subsequent evaluation and approval of EIA studies as the environmental clearance for project implementation. Project categorization is done through the

submission, by the proponent, of a Screening Report and a Preliminary Environmental Information Form. MICOA will determine the Category based on the information submitted by the proponent. Moreover, only firms and experts registered and approved by MICOA are eligible for the conduct of EIA studies in Mozambique.

As such in this project case, MICOA in coordination with DPCA-Nampula has determined that no further environmental impact assessment study is necessary for this project as noted under Section 1-4-1-1 above.

The Schematic Flow of the EIA process in Mozambique is shown below in Figure 1-14.



(Source: MICOA)-TAC: Technical Advisory Committee

Figure 1-14 Schematic Flow of the EIA Process in Mozambique

1-4-1-4 Alternatives including Zero Option

(1) Project substation (SS) site location alternatives

An alternative site for the SS (Alternative 1) was initially chosen under the scope of the NORCONSULT Feasibility Study on the Chimuara-Nacala Transmission Project (2013) that was located about 800 meters from the current Namialo site as per this project (Alternative 2). The locations of both of these alternatives are shown in Figure 1-15. The site selected under the Feasibility Study on the Chimuara-Nacala Transmission Project was assessed as less advantageous in comparison to the current Namialo SS site of this project with respect to both environmental and social effects due to erosion potential, closer proximity to the Namialo village and a higher potential for economic relocation of farmlands for the Project site.

A summary of a comparative evaluation of both of these alternatives is given below in Table 1-12 that justifies the selection of Alternative 2 as per this project site as the best option with the least adverse environmental and social effects.

Table 1-12 Alternative Comparison for Location of the Namialo Substation

Relevant Comparative Aspects		Alternative 1 (NORCONSULT Location)	Alternative 2 (Proposed Location by this project)
Land use	Overall land use	Small-scale farmlands	Similar to Alternative 1, still small-scale farms are less in number
	Protected/ecologically/culturally important areas	None	Same as Alternative 1
Environmental and Social Aspects	Social Environment	Closer to the Namialo village with more small-scale farms	Further from the Namialo village with fewer small-scale farms
	Natural Environment	Soil erosion prone area	Firm soil ground area that is not erosion-prone
Recommended alternative and its reason		Not recommended	Recommended since less economic loss of farmland and less adverse social effects since the location is not as to closer to the Namialo village. Also located in a firm soil ground area (non-soil erosion prone area)

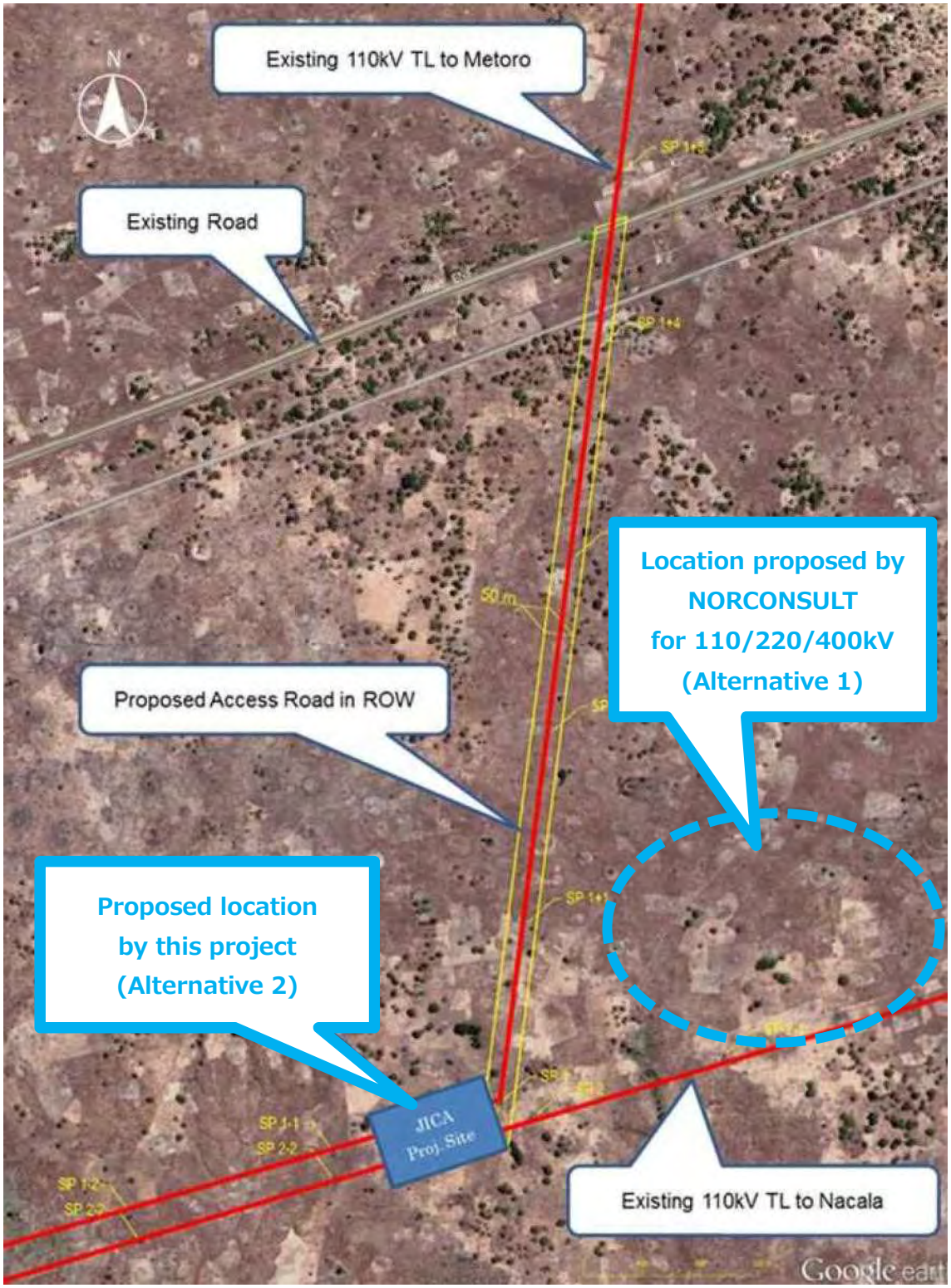


Figure 1-15 Alternative Locations of the Project

(2) Zero option

Zero option is always a viable option for the existing condition and would basically amount to a continued inefficient usage of the exiting transmission line system that would affect the provision of electricity with a stable power supply for households and also the power supply for potential agro-industrial development of the area. As such, it is regarded as an unwise option to contemplate, particularly at the current state with the existing transmission line system in place.

1-4-1-5 Scoping

Scoping for significant environmental and social aspects for the project essentially belonging to industrial sector was conducted based on the typical and relevant environmental and social components.

Such relevant components are broadly classified into 3 environmental groups, namely, environmental quality and pollution control, natural environment, and social environment and are used as the basis for scoping.

Classification and the relevant environmental (and social) elements selected for scoping are summarized below in Table 1-13.

Table 1-13 Classification and the relevant Elements

Classification of Environment		Environmental (and social) elements
1	Environmental quality and pollution control	Air quality Water quality Noise/vibration Waste Soil Climate change factors
2	Natural environment	Topography Geology Hydrology Ecosystem Biodiversity Protected areas Area of environmental/ecological significance
3	Social environment	Local economy Resettlement Livelihood Indigenous people Cultural heritage Health and safety

The results of scoping with evaluation separated between positive (beneficial) and negative (adverse) effects with 4 ranking grades of A, B, C and D along with due reasoning for such ranking are given below in Table 1-14.

Table 1-14 Environmental Scoping for the Namialo SS Project

Classification of Environment	Environmental Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
Environment quality and pollution control	Air quality	B-	D	During construction, air pollutant emissions are expected from land clearance, movement of heavy equipment, and trucks, which would generate mostly dust as well as some gaseous exhaust emissions (CO, NO_x, SO_x and others). During O&M, no significant air pollutant emission is expected since SS operation does not result in any gaseous emission.
	Water quality	D	D	There are no significant surface water bodies in the vicinity of the project area. So no adverse effects on water quality that are of consequence to the project are anticipated.
	Noise/vibration	B-	B-	Noise and vibration during construction/installation work cannot be entirely eliminated. Still, since the project area location is rather remote, a relatively high tolerance level for noise/vibration is permissible, in particular considering the short-term nature of the adverse effects. Moreover, work prone to potentially high noise/vibration could also be scheduled for the day time only. Operation of the SS is rather noise- and vibration-prone. In this regard, provision of a green area around the SS could be adopted as a long-term mitigation measure.
	Waste	B-	D	Waste generation during construction activities include sanitary and solid waste generation due to working personnel, worker camps and other construction-related work. Waste generated due to the operation of the SS is not a large quantity and hence not that significant.
	Soil	D	D	No significant adverse effect on soil is anticipated since the work involves predominantly overland construction/installation for the SS and the access road to the SS.

Classification of Environment	Environmental Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
	Climate change Factors	D	D	The Namialo SS is too small to cause any significant increase in generation of CO_2 during construction work. Also during operation, there will be some reduction in generation of CO_2 due to the improved energy efficiency of electricity transmission and utilization. Still, the effect is not very significant.
Natural Environment	Topography	D	D	The project is not that large-scale to significantly affect topography.
	Geology	D	D	Similar to the topography case above, the project is not so large-scale as to significantly affect geology.
	Hydrology	D	D	Similar to the topography case of above, the project is not so large-scale as to significantly affect hydrology.
	Ecosystem	D	D	The project site is located along existing transmission lines with a high anthropogenic/human influence. So no adverse effect on the ecosystem is anticipated.
	Biodiversity	D	D	Similar to the ecosystem case above, no significant adverse effect on biodiversity is anticipated due to SS construction/installation and operation.
	Protected areas	D	D	There are no protected areas located in or around the vicinity of the project area.
	Areas of environmental /ecological significance	D	D	There are no environmentally or ecologically significant, critical or vulnerable areas located in or around the vicinity of the project area.
Social Environment	Local Economy	B+	B+	Project construction/installation work would generate some employment opportunity for the local labourers, though mostly for unskilled labour thereby contributing to the local economy. This is also possible to some extent during the operation phase as well, for operation, maintenance, and security of the new Namialo SS.
	Resettlement	D	D	No requirement for resettlement of the population is anticipated since the project area is uninhabited.
	Livelihood	B-	D	Some economic loss due to loss of predominantly small-scale subsistence farmlands is anticipated. This has the potential to affect the livelihood of such affected farmers.
	Indigenous people	D	D	Project is not expected to exert any effects on indigenous people since there are no indigenous people living around the vicinity of the project area.
	Cultural Heritage	D	D	There are no cultural heritage sites located in and around the vicinity of the project area.

Classification of Environment	Environmental Element	Impact Evaluation		Reasons for Evaluation
		Construction Stage	Operation and Maintenance Stage	
	Health and Safety	B-	D	Health and safety of construction personnel is a very important aspect in the construction management by the contractor. Instilling due awareness among migrant workers on the dangers of communicable diseases and the importance of respecting the customs and traditions of village people is the most significant social aspect to be addressed by the construction contractor. Commitment and adherence to the concept of "Safety First" by the construction contractor in all construction/installation-related activities is very important. Operational safety of the SS could be duly ensured by the EDM-North region that has ample experience on the operational management of SS.

Legend:
A+/- : Significant positive/negative impact is expected
B+/- : Positive/negative impact is expected
C+/- : Extent of positive impact/extent of negative impact is unknown (needs further investigation on whether the impact can be clarified as the ESC Study progresses)
D : No significant impact is expected or no impact at all is expected

It is evident from the above scoping results that most adverse effects of consequence to the implementation of the SS in Namialo are short-term, basically confined to the construction/installation stage of the project, and could be managed with the adoption of good construction/installation practices by the construction contractor. Also, in the absence of population resettlement requirement there are no highly significant social issues involved.

Still, there are some small-scale and predominantly subsistence-oriented agricultural farmlands located in the proposed SS project area and its access road. Relocation of such farmlands has the potential to affect the livelihood of such small-scale farmers. In this regard and in order to ensure that the livelihood of such relocated farmland holders are not degraded in comparison to their current status of livelihood, a simplified land use compensation plan study, referred to as the SLUCP (Simplified Land-use Compensation Plan), was also incorporated as the very significant social component of the TOR for the project, also noted in the following section.

1-4-1-6 TOR for Environmental and Social Considerations Survey (ESCS)

The proposed TOR for this survey, which was also incorporated into the TOR for subcontract on ESCS as attachment is given in Table 1-15.

Table 1-15 TOR for Environmental and Social Considerations for Namialo SS

Environmental element		Methodology	Requirements/Parameters
1	Meteorology	Secondary data collection (data from the EIA report of September 2013 for the Chimuara-Nacala Energy Transport Project as the base)	a) One observation station near the Project site b) Parameters ▪ Monthly highest, lowest and average of temperature ▪ Monthly highest, lowest and average of humidity ▪ Monthly wind direction and speed ▪ Monthly highest, lowest and average of solar radiation ▪ Monthly rainfall ▪ Number of lightning days
2	Hydrology	Secondary data collection and/or interview with local residents	a) General hydrological conditions in and around the Project site b) Information regarding historical floods in and around the Project site
3	Water Quality	Secondary data collection for surface water quality with primary water quality sampling and analysis for groundwater quality at one deep well with hand pump as well as an interview with related agencies	a) Water quality conditions in nearby rivers and deep-wells including sampling and analysis of groundwater quality (one sampling at existing deep-well with hand-pump) for typical potable water quality parameters. b) Confirmation of environmental standards
4	Air Quality	Secondary data collection and interview with related agencies	a) Air quality condition in and around the Project site b) Confirmation of environmental standards
5	Noise Level	Secondary data collection and interview with related agencies	a) Noise level in and around the Project site b) Confirmation of environmental standards
6	Waste Management	Secondary data collection and interview with related agencies	a) Waste management system in the Project area b) Confirmation of waste management standards

Environmental element		Methodology	Requirements/Parameters
7	Natural Environment and Ecosystem	Desktop study and Field Reconnaissance survey (including the EIA report from September 2013 (approved by the MICOA in December 2013) for Chimuara-Nacala Energy Transport Project)	a) Land use, terrestrial ecology, vegetation, etc.
8	Socio-economy	Reconnaissance survey and simplified Socio-economic survey as primary data collection (including SLUCP-related works) and also as secondary data of the EIA report from September 2013 for the Chimuara-Nacala Energy Transport Project as appropriate/relevant.	a) Necessity/need/non-necessity of land acquisition/ relocation b) Survey on population census, property, and land use/lease for all land users/farmers (all farmers are small-scale) in the project site c) Survey on living and livelihood (socio-economic survey) for at least 20% of potentially project-affected land users/land leasers/farmers in the project site d) Conditions/Criteria on recipients for compensation of land use/farm loss and measures for livelihood rehabilitation e) Procedure for compensation of property loss/land-use loss using the replacement cost, based on the replacement price survey f) Measures for livelihood rehabilitation including alternatives which can improve or at least restore the recipient's standard of living, income opportunities, and production levels to pre-project levels, based on the needs survey for livelihood rehabilitation g) Procedure, authority of organization for the processing of complaints h) Identification of responsible entities for relocation, in particular the small-scale farms (e.g., project entity, municipality, consultants, NGOs, etc.) and their authorities i) Schedule for displacement after payment of compensation for property/land-use loss j) Cost and financial sources k) Monitoring system by project entity and monitoring form l) Result of the stakeholder consultation meeting

Environmental element		Methodology	Requirements/Parameters
9	Stakeholders' Engagement	Perception survey, stakeholders' consultation, focus group discussions, etc. (primary data collection)	a) Perception of local communities and other stakeholders about the Project, what environmental issues and impact they think are important, etc.

The subcontract for conducting the environmental and social consideration survey, referred to as ESCS, was initiated in July 2014 and covered both by an EIA study as SES (simplified environmental study) or SER (simplified environmental report) for a Category B project and by an SLUCP study. It is noted that the SLUCP study is intended as duly compensating and assisting those small-scale farmland holders, whose farmlands have to be relocated (PAPs/project affected persons), so that their livelihood is not adversely affected consequent to the relocation of their farmlands. The SES and SLUCP (ESCS) final reports were completed in January 2015 and the results are incorporated into this report.

1-4-1-7 ESCS Results

As the most significant primary data collection for the SES/EIA of the ESCS, groundwater quality sampling and analysis for typical potable water quality parameters were conducted in a dug-well about 5 m deep located in the vicinity of the project area. The results of the analysis are evaluated as given below in Table 1-16.

Table 1-16 Evaluation of Groundwater Water Quality in the Project Site

Environmental Component	Groundwater Quality Evaluation of existing dug-well located in the vicinity of the project area for potable use
Groundwater quality	The overall groundwater water quality of the dug-well is assessed as very good for direct potable use since all measured parameters met the drinking water quality standard requirement.

Moreover, comparative evaluation made based on the results of environmental scoping following the completion of the ESCS (Environmental and Social Consideration Survey), and hence based on the results of the ESCS, composed of the SES/EIA and SLUCP, is given below in Table 1-17.

Accordingly, no changes in scoping results are encountered following the completion of the ESCS. This could be attributed to the conventional nature of the Namialo SS project with ample experience in similar projects constructed and in operation with its rather favorable location with fewer environmental and social constraints.

Table 1-17 Comparative Evaluation on Results of Scoping

Item		Impact by Scoping		Impact based on Study Results		Reason for Evaluation
		Const.	O/M	Const.	O/M	
Environmental Quality and Pollution Control						
1	Air quality	**B-**	**D**	**B-**	**D**	• Air pollution mainly due to dust during construction works
2	Water quality	**D**	**D**	**D**	**D**	• There are no surface water bodies in the vicinity of the project area
3	Noise/vibration	**B-**	**B-**	**B-**	**B-**	• Noise/vibration during construction work and potential for its mitigation with green area around the SS during operation

Item		Impact by Scoping		Impact based on Study Results		Reason for Evaluation
		Const.	O/M	Const.	O/M	
4	Waste	**B-**	**D**	**B-**	**D**	• Waste management during construction works including worker related sanitary and solid waste. No large scale waste generation during operation of SS.
5	Soil	**D**	**D**	**D**	**D**	• Construction/installation work is predominantly overland.
6	Climate change factors	**D**	**D**	**D**	**D**	• Insignificant effect due to relatively small scale of the project
Natural Environment						
7	Topography	**D**	**D**	**D**	**D**	• No significant effect on topography
8	Geology	**D**	**D**	**D**	**D**	• No significant effect on geology
9	Hydrology	**D**	**D**	**D**	**D**	• No significant effect on hydrology
10	Ecosystem	**D**	**D**	**D**	**D**	• No significant effect on ecosystem
11	Biodiversity	**D**	**D**	**D**	**D**	• No significant effect on biodiversity
12	Protected areas	**D**	**D**	**D**	**D**	• There are no protected areas in or around the vicinity of the SS project area
13	Areas of environmental /ecological significance	**D**	**D**	**D**	**D**	• There are no environmentally /ecologically significant protected areas in or around the vicinity of project area
Social Environment						
14	Local economy	**B+**	**B+**	**B+**	**B+**	• Local work opportunities during construction work and subsequent operation/maintenance of the SS.
15	Resettlement	**D**	**D**	**D**	**D**	• No resettlement of households is involved as the affected project area is uninhabited.
16	Livelihood	**B-**	**D**	**B-**	**D**	• 19 households with small-scale farmlands are affected due to their farmland relocation. This could be duly compensated and accomplished with the implementation of the SLUCP as proposed by the ESCS study. Still, proper implementation of the SLUCP is essential.
17	Indigenous people	**D**	**D**	**D**	**D**	• There are no indigenous people in or around the vicinity of project area
18	Cultural heritage	**D**	**D**	**D**	**D**	• There are no cultural heritage sites in or around the vicinity of project area
19	Health and safety	**B-**	**D**	**B-**	**D**	• Health and safety of construction personnel is very important. No significant safety issues exist in conventional operation of the SS.

Legend:
A+/- : Significant positive/negative impact is expected
B+/- : Positive/negative impact is expected
C+/- : Extent of positive impact/extent of negative impact is unknown (needs further investigation and clarification on whether the impact can be clarified as the ESC Study progresses)
D : No significant impact is expected or no impact at all is expected

1-4-1-8 Environmental Impact Evaluation

The potential adverse environmental impacts as a result of the construction and operation of the Namialo Substation is assessed as manageable with the implementation of conventionally well-known and applied environmental management (including mitigation) and monitoring measures. This could also be visualized from the existence and operation of a large number of substations in Mozambique (in fact there are 2 substations in Nampula itself) and around the world.

The relevant environmental management/mitigation and monitoring measures as identified by the SES/EIA of the ESCS are illustrated in Section 1-4-1-9 (Environmental Management/Mitigation Plan) and Section 1-4-1-10 (Environmental Monitoring Plan and Monitoring Form).

1-4-1-9 Environmental Management/Mitigation Plan

(1) Management/Mitigation Measures

During the construction stage of the project the construction contractor will be principally responsible for the implementation of environmental management, mitigation, and monitoring measures. Such environmental management and mitigation measures of construction could be duly accomplished with the adoption of good construction practices by the construction contractor in combination with duly diligent adherence to the "Safety First" concept and EHS (environment, health, and safety) aspects of all construction and installation work related activities.

The significant environmental mitigation measures of construction work identified by the SES study include, among others, covering vehicles carrying dust prone materials, using machinery and vehicles of good quality with proper maintenance, spraying water to control dust generation at the construction site, re-vegetating bare lands at construction site as soon as possible, maintaining sanitary conditions in camp and work sites, restricting activities causing high noise/vibration to daytime only, and waste management with due waste segregation focused on the 3Rs (reduce, reuse, and recycle) and proper disposal management of all waste generated.

In regard to waste management, it is noted that currently the Namialo area has no formal solid waste collection and disposal service provided by the Miconta District Authority and the solid waste generated by the villagers of Namialo is informally managed (i.e., burned/buried). So the construction contractor, if necessary, has to establish his own specific landfill site for final disposal of solid waste generated from the construction work. Still, in the case of generating hazardous waste (not expected in significant quantities for this project), it shall be transported to the dedicated Mavoco landfill in the Matola Municipality (Maputo Province).

The environmental management and mitigation plans as identified by the SES/EIA (simplified environmental study/environmental impact assessment study) separated between construction and

operation phases of the project are given respectively in Table 1-18 (construction phase) and Table 1-19 (operation phase).

(2) Cost of Management/Mitigation Measures

The cost of environmental management/mitigation measures during the construction phase of the project that shall be under the direct responsibility of the construction contractor is incorporated into the overall construction cost of this Namialo SS Project. The cost of environmental management/mitigation measures during the operation phase of the project that shall be under the direct responsibility of the EDM-North Region is incorporated into the overall operational management cost of the newly constructed Namialo SS.

Table 1-18 Environmental Management/Mitigation Plan–Construction Phase

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Construction activities (i.e vegetation clearing, topsoil removal) and transportation, including movement of heavy machinery	Geology, geomorphology and soils	Changes in relief of landscape	Protection of areas that may be changed in terms of relief	▪ Protection with terraces and vegetation. ▪ Rehabilitation of borrowed pits after use.	Contractor
		Increase of soil erosion and/or compaction due to construction activities	Reduce soil erosion/compaction	▪ Minimize work in the rainy season. ▪ Limit access to the project area to the necessary minimum and remove as little vegetation as possible. ▪ Avoid creating large open expanses of bare soil as these are most susceptible to wind and run-off erosion. In such areas, if necessary, create windbreaks (e.g. a tree screen). ▪ Suitable drainage systems should be installed to direct water and prevent waterlogging and erosion. ▪ After construction, all non-paved areas should be reinstated with the topsoil to allow the reestablishment of the indigenous herbaceous vegetation. ▪ All bare areas should be re-vegetated as soon as possible. ▪ All vehicles and machinery should only use indicated routes and access roads.	Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Construction activities (i.e vegetation clearing, topsoil removal) and transportation and demolition activities	Air Quality	Air Pollution Resulting from Emission of Pollutants from transportation and construction activities	Reduce air pollutant emissions	▪ Good maintenance of engines, vehicles and machinery ▪ Use new, modern machinery and vehicles. ▪ Repair and eventually replace machinery and vehicles when they exceed norms. ▪ Loads on vehicles carrying dusty construction materials should be covered. ▪ Loading and unloading bulk construction should be in areas protected from the wind and in calm conditions. ▪ Vehicles carrying dusty materials should be washed before leaving the site (washing facilities should be available). ▪ Limit access to construction site to construction vehicles only. Impose vehicle speed restrictions on the construction site. ▪ Maintain high moisture content on exposed surface and roads by spraying with water. ▪ Maintain construction vehicles to ensure optimum performance with reduced emissions.	Contractor
Construction activities (i.e construction of infrastructures)	Hydrology	Changes to runoff	Manage changes of hydrological features	▪ Maintain machinery and vehicles in workshops with sealed floors during all Project phases. ▪ Collect waste oils in designated containers and transport them to the designated disposal/recycling site ▪ Do not dispose of untreated wastewater. ▪ Monitor the impact of local erosion due to water flow and, if impact is significant reduce run-off	Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Construction activities (i.e biomass cut when cleaning the land, packaging, leftovers and defective parts of conductor cable, broken insulators, waste produced by equipment maintenance, solid waste from the worker's camps, grey and sewage water produced in camps)	Waste	Production of waste	Ensure waste is treated according to the local norms	▪ Minimize the use of disposable materials. • Train workers how to minimize and treat waste. ▪ Dedicate resources to collecting, sorting, depositing, reusing and recycling according to norms with special emphasis on metallic waste. ▪ Avoid spillage of waste oil and others	Contractor
		Generation of waste from demolition of transmission towers	Ensure solid waste is treated according to the local norms	▪ Minimize the use of disposable materials. ▪ Train workers on how to minimize and treat waste. ▪ Dedicate resources to collecting, sorting, depositing, reusing and recycling, with special emphasis on metallic waste.	Contractor
Construction activities (i.e vegetation clearing, topsoil removal) and transportation and demolition of transmission towers	Noise and Vibration	Increase in noise and vibration levels due to transportation and construction activities and demolition of transmission towers	Reduce noise and vibration levels	▪ Transportation of workers, equipment and materials should be undertaken during the day, especially in inhabited areas. ▪ Use modern vehicles and ensure that these are well maintained. ▪ Monitor the level of noise emissions and ensure they are within the accpetable limits. ▪ Repair and eventually replace machinery and vehicles when they exceed norms. ▪ The Contractor should take measures to inform communities about the start of the work and the time limit foreseen for its conclusion; the working hours established by law should be adhered to and respected. ▪ Work continuation during evenings, weekends and holidays should be	Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
				minimized. ▪ Whenever possible, machines and vehicles should be equipped with silencers. ▪ When possible use noise barriers such as materials resulting from earthworks, trees. ▪ All construction workers must be issued with the necessary protective equipment. ▪ Construction work should be limited to the daytime (08:00-18:00) as much as possible, this is a must for activities causing high noise/vibration.	
Construction activities (i.e vegetation clearing)	Fauna and Flora	Loss of flora and fauna due to construction activities	Reduce the loss of fauna and flora	▪ Restrict the access of the Contractor particularly outside of the area where the project will be implemented and reduce the construction work area to a minimum in these areas. ▪ Guarantee the contractor has a license for clearing vegetation. ▪ Limit cutting of trees to the site only. ▪ All vehicles and machinery should only use indicated routes and access roads and therefore no off-road driving. ▪ Apply mechanical vegetation control measures.	Contractor
Construction activities associated with the demolition of transmission towers or establishment of new infrastructures namely 2 new transmission towers and substation	Landscape and Visual	Change in the visual landscape due to the building of the substation	Reduce the visual impact caused by construction works	▪ Limit construction activities to the construction areas only to minimize visual and landscaping impacts	Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Construction activities associated with the movement of heavy machinery	Traffic and transport	Changes in intensity and traffic flow due to trucks, extraordinary transport and others	Manage traffic flow	▪ Transport extraordinary cargo outside of rush hour and if necessary accompanied by traffic police. ▪ Place signs and safety barriers. ▪ Educate workers to follow traffic rules. ▪ Reduce roadblocks to a minimum. ▪ Ensure loads prone to dust are well covered.	Contractor
Construction activities (i.e new employment opportunities for local and people from other areas; accidents associated with construction phase such as working at heights)	Health	STI's in the population and workers safety and health	Reduce health impacts associated with migration of people to project site	▪ Education of the public and workers on risks and health hazards and legal norms on infection, testing, and sexual behaviours. ▪ Availability of condoms to employees and sales points around the camps. ▪ Access to health services, medicine. ▪ For the workers, ensure provision of mosquito nets, health facilities at camps, maintain a sufficient stock of medicines and prophylactics as first-line treatment of malaria, availability of clean water and adequate sanitary equipment/materials.	Contractor
		Work accidents	Reduce work accidents and risk of injury	▪ Train workers in occupational safety and health. All contractor teams involved in work during the construction phase shall be briefed on their obligations toward health & safety controls and methodologies. The briefing must take the form of a presentation and demonstration. The education / awareness programme should be aimed at all levels of management and general staff within the Contractor teams. An attendance register shall be signed at this briefing. Local labourers hired for the construction phase must receive training	Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
				related to health & safety awareness prior to commencement of the work. ▪ Periodic exercise and simulation. ▪ Rewards for good behaviour. ▪ Train employees in first aid. ▪ Reserve a vehicle for emergency needs such as transportation of patients at work site.	
Construction activities (i.e employment opportunities, migration of workers to areas near the site)	Economy	Loss of crops, crop areas and other economic opportunities	Minimize and compensate economic losses for local communities	▪ Advise farmers before construction so that they can harvest their crops. ▪ Compensate for the value, land and opportunities lost in a compensation plan. To this extent a Simplified Land-Use Compensation Plan (SLUCP) has been prepared.	EDM
		Direct employment	Incremental employment opportunities for local workers	▪ Prioritize recruitment of local workers. ▪ Use temporary employment for the training of local people. ▪ Prioritize procedures of intensive hand labour instead of machinery	EDM and Contractor
		Indirect employment due to induced development	Ensure linkages and benefits from implementation of the project are also translated to local and national suppliers	▪ Prioritize local and national suppliers. ▪ Invest in training of local service providers. ▪ Connect the Project to investment. ▪ Encourage investment that allows the recruitment of more local hand labour.	EDM and Contractor

Phase: Construction					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Construction activities (i.e employment opportunities, migration of workers to areas near the site)	Tensions	High expectations with regards to employment opportunities	Manage work expectations	▪ If local workers (non-specialized and/or semi-specialized) will be necessary, the project must as far as possible incorporate and maximize the use of local labour. This should be best coordinated with the local authorities and with the provincial Directorate of Labour. ▪ In the Contractor's contract, the number of work places to be opened for local staff should be stipulated, including hiring requirements, the maximum duration of the work, recruitment procedures, and wage levels.	EDM and Contractor
		Social conflict due to physical presence of external workers	Avoid conflicts	▪ Both, workers and local communities, should be subject to awareness-raising campaigns, so as to promote good relations, thus avoiding the occurrence of conflicts.	EDM and Contractor

Table 1-19 Environmental Management/Mitigation Plan–Operation Phase

Phase: Operation stage					
Activity **Description of Activity**	**Environmental Items**	**Impact**	**Objective**	**Mitigation Measures**	**Implementation Agency**
Operation activities (ie replacement of broken parts, maintenance of substation and domestic waste from workers)	Waste	Production of waste	Ensure waste is treated according to the local norms	▪ Minimize the use of disposable materials. ▪ Train workers how to minimize and treat waste. ▪ Dedicate resources to collecting, sorting, depositing, reusing and recycling according to norms. ▪ Avoid spillage of waste oil and others	EDM – North Region
Operation activities	Air quality	Air pollution resulting from emission of pollutants from the operation	Reduce air pollutant emissions	▪ Good maintenance of engines, machinery and vehicles ▪ Use new, modern machinery and vehicles ▪ Repair and eventually replace machinery and vehicles when they exceed norms.	EDM – North Region
Operation activities (ie machinery and equipment operation)	Noise and Vibration	Increase in noise levels due to substation operation	Reduce noise and vibration levels	▪ A barrier of mature trees or high soil berms (green area) between the substation and nearby residences can be helpful in reducing noise impacts.	EDM – North Region
Operation activities (i.e operation of the substation)	Energy Supply	Improved energy supply	Guarantee long term power supply	▪ Ensure integration of the project in the investment strategies in the four provinces affected by the Chimuara-Nacala Transmission Project.	EDM – North Region
Operation activities (i.e employment on the substation during operation phase)	Economy	Direct employment	Incremental employment opportunities for local workers	▪ Prioritize recruitment of local workers. ▪ Use temporary employment for the training of local people. ▪ Prioritize procedures of intensive hand labor instead of machines	EDM – North Region

1-4-1-10 Environmental Monitoring Plan and Monitoring Form

The proposed environmental monitoring plan for the construction phase of the project to be implemented by the construction contractor is composed of ambient air quality monitoring focused on dust dispersal (measured as $PM_{2.5}$ and PM_{10}) and noise and vibration. In this respect it is noted that currently Mozambique lacks air quality standards for $PM_{2.5}$ and PM_{10} (the standard is only for general particulate matter as TSP) as well as for noise and vibration. As such, international standards like those of IFC/WB will be adopted.

During the operation phase of the substation, no significant adverse environmental effects are anticipated with the provision of a due buffer zone having a green area around the substation to mitigate any potential noise and vibration effects related to the operation of the substation. Still, a limited quantity of waste will be generated by the management workers, including sanitary waste and other substation-operation-related waste, such as waste lubricant oils and other mechanical parts deemed obsolete or unusable. Such waste shall be duly managed with good house-keeping practices. The EDM North Region will be the responsible agency for the overall operational management of the substation that will also include management of all waste generated in the substation.

The proposed environmental monitoring plan on a tentative basis by the SES and the relevant environmental monitoring form are given respectively in Table 1-20 (monitoring plan) and Table 1-21 (monitoring form).

Table 1-20 Environmental Monitoring Plan for the Project for Reinforcement of the Transmission Network in the Nacala Corridor in the Republic of Mozambique

Environmental Items	Environmental Parameters/ Monitoring Item	Unit	Mozambique Standards: Decree 18/2004 and supplement 67/2010	Referred International Standards – WB/IFC Guidelines	Remarks (Measurement Point, Frequency, Method)	Responsible Agency	Cost of Monitoring
Construction Phase							
Air Quality	SPM_{10}	$\mu gm/m_3$	Not Specified	50 150 Interim Value	·One Sampling Point near the project site and one sampling point 1 km away from the project site ·At least once in three months (one every season) – one 24 hr. day sampling ·High Volume Dust Sampler may be used	Implementation – Contractor / EDM	5000 USD per set Included in the overall construction cost
	$SPM_{2.5}$	$\mu gm/m_3$	Not Specified	35 75 Interim Value	· One Sampling Point near the project site and one sampling point 1 km away from the project site ·At least once in three months (one every season) – one 24 hr. day sampling ·High Volume Dust Sampler may be used	Implementation – Contractor / EDM	5000 USD per set Included in the overall construction cost
Noise and vibration	Noise and vibration level	dB	Not Specified	70 (Night-time) 70 (Day-time) (Industrial Area)	100m from the construction site Per Month one 24-hr. day sampling Sound level meter	Implementation – Contractor / EDM	5350 USD per set Included in the overall construction cost
Waste	Solid waste (including demolition waste) Sanitary waste Housekeeping waste	-	-	-	Worksite and camp site (weekly)	Implementation – Contractor / EDM	Included in the overall construction cost
Operation Phase							
Waste	Solid waste and sanitary waste Housekeeping waste of the substation	-	-	-	Substation Worksite (weekly)	Implementation – EDM (North Region)	Included in the overall operation cost

Table 1-21 Environmental Monitoring Form for the Project for Reinforcement of the Transmission Network in the Nacala Corridor in the Republic of Mozambique

Environmental Parameter	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Mozambique Standards: Decree 18/2004 and supplement 67/2010	Referred International Standards - WB/IFC Guidelines	Remarks (Measurement Point, Frequency, Method)
Construction Phase							
Air Quality	SPM_{10}	$\mu gm/m^3$			Not Specified	50 150 Interim Value	One Sampling Point near the project site and one sampling point 1 km away from the project site ·At least once in three months (one every season) – 24 hr. day sampling ·High Volume Dust Sampler may be used
	$SPM_{2.5}$	$\mu gm/m^3$			Not Specified	35 75 Interim Value	One Sampling Point near the project site and one sampling point 1 km away from the project site ·At least once in three months (one every season) – 24 hr. day sampling ·High Volume Dust Sampler may be used
Noise and vibration	Noise and vibration level	dB			Not Specified	70 (Day-time) 70 (Night-time)	· 100m from the construction site · Per Month one 24-hr. day sampling · Sound level meter
Waste	Solid waste (including demolition waste) Sanitary waste Housekeeping waste						Worksite and camp site (weekly)
Operation Phase							
Waste	Solid waste and sanitary waste Housekeeping waste of the substation						Substation Worksite (weekly)

1-4-1-11 Public Consultation

A public consultation (participation) meeting was held on 22nd August 2014 at the district administration office of Meconta with concerned participants composed of district cum local government administration officials, traditional village officials/leaders, and also influential local personnel as a very significant component of the ESCS study. The meeting was presided by the District Administrator of Meconta that was composed of 39 participants. Pertinent information concerned with the public consultation meeting is summarized below in Table 1-22.

Table 1-22 Pertinent information for the public consultation meeting

Date & Time	August 22nd 2014, 10 AM to 12 Noon
Venue	Meeting Room of the Meconta District Administration
Participants	39 in total, including concerned Meconta district and local government officials and village leaders and other local influential persons.

During the public consultation (participation) meeting presentation on the project, objective and project descriptions were made by the EDM North Region as the representative project proponent. This was followed with the presentation by the public consultation expert of the ESCS on the findings and results of the draft SES (simplified environmental study/environmental impact assessment study) of the project.

Question-and-answer sessions followed the presentation, and the participants raised no major issues detrimental to the implementation of the project.

In general, participants welcomed the implementation of the project that is expected to alleviate the extreme lack of access to electricity currently encountered by the households of Namialo. In fact, they were eager to know when the implementation of the Namailo SS project would commence. (EDM answered that a commencement date has not been decided yet).

Moreover, the following were noted as the most significant aspects raised in the public consultation meeting:

- Involvement of the District Authority by the EDM during project implementation was emphasized
- Hiring of labor for the project gives preference/priority to local labor

1-4-2 SLUCP Aspects on Farmland Relocation

1-4-2-1 Farmland Relocation including Consultation with PAPs

There are in total 19 farming households with small-scale farmland and fruit trees located in the planned Namialo SS project area, including its access road. As such their (the PAPs) livelihood would be potentially affected by the project since their farmland and related assets have to be relocated to facilitate the implementation of this project.

As such, in order to ensure the livelihood of these 19 households are not adversely affected by the implementation of the project, an SLUCP (Simplified Land-use Compensation Plan) was formulated, as also noted in the previous sections under subcontract as a component of the ESCS. It is further noted that there is no housing (human settlements) in the project area and its immediate vicinity. So no resettlement of the population is involved.

In this respect, the SLUCP team consulted with all 19 household heads (PAPs) in July 2014 in the form of a direct interview survey, so as to discern their general expectations regarding the project. There is a general satisfaction among them regarding the implementation of a new project in the Meconta (Namialo) area, particularly if this project is likely to provide tangible benefits to the local communities that will be directly or indirectly affected by the project. Monetary compensation was mentioned by the PAPs as one of the most important tangible benefits, followed by the provision of employment in the construction and operation of the substation (SS). There is a general sense that if the project proponent provides an acceptable alternative means of compensation, the PAPs would easily accept the implementation of the Namialo SS and they would be open to a discussion and agreement on possible means of relocation and compensation.

The SLUCP was formulated to duly compensate and restore the livelihood of the affected farming households at least to their current living status and hence to meet their expectations as illustrated in the following sections.

1-4-2-2 Legal Framework on Land Acquisition and Compensation

The Constitution of the Republic of Mozambique states, in fundamental principle, all natural resources and means of production are public property of the collective interest. Therefore, the land belongs to the State and the right to use it can only be granted by the State through a formal land use title (DUAT). This position is corroborated by the Land Law (Law 19/97) that covers regulation for the key aspects of land occupation and use in Mozambique. Specifically, according to this Land Law all land belongs to the State and the land cannot be sold, transferred, mortgaged, or pledged (Land Law, Article 2).

However, although land is owned by the State, all Mozambican citizens (regardless of gender), legal persons, and local communities have the right to use and enjoy the land (i.e., the right to land use) and

benefits thereto (Land Law, Article 3). Article 9 of the Land Law recognizes the legitimacy of the occupation of land by individuals or communities via traditional structures and customary rights, while Article 10 provides for the rights derived from the occupation of land by Mozambican individuals when the occupation is in good faith and extends for more than 10 years, even without a DUAT title. Thus, the absence of a DUAT issued by the official cadastral services does not imply any loss of rights over land.

Under the DUAT, the right for use and exploitation of land for economic activities is granted for a maximum period of 50 years, renewable for an equal period on request by the interested party (Article 17). The right of use and exploitation of land occupied by traditional communities is not limited by any term (Art.17-2).

A land-use title obtained either by DUAT or by customary norms and practices, may be revoked when this is in the public interest, preceded by provision of fair compensation (Article 18). Procedures for the termination of a land title in the public interest must follow expropriation procedures and prior payment of fair compensation.

The Ministerial Diploma 181/2010 regulates the process of expropriation of lands for projects declared as being of public interest. The directive contains specific guidelines to the compensation of losses induced by such expropriation. A basic guide on compensation for permanent and annual crops is provided and updated by the Provincial Directorates of Agriculture (DPA). The guideline on compensation is based on the current market price and productivity values for various annual and permanent crops.

The legal (and policy) framework and entitlements adopted in this SLUCP are based on relevant national regulations of Mozambique as described above and the policy of JICA on Involuntary Resettlement and related aspects, though involuntary resettlement is not involved.

There are some legal gaps between the national regulations of Mozambique and that of JICA concerning land acquisition, resettlement, and compensation aspects, although in recent years the national legislation has been upgraded significantly as a result of the need for greater protection of the public interest and their property.

Therefore, the present SLUCP adopted the policies and procedures set out in the guidelines of JICA, jointly with the best practices established by national legislation. As a result, the SLUCP strived for harmonization between the two instruments, safeguarding whenever possible the best interest of the PAPs. So where Mozambican legislation somewhat differs or does not mention specific issues, the principles of the JICA guidelines are adopted. These aspects include the eligibility of persons without legal rights to the land, grievance and redress mechanisms, and others.

Gaps between Mozambican legislation and the JICA guidelines, in the context of the SLUCP, are given in Table 1-23.

Table 1-23 Gaps between JICA Guideline and Mozambican Legislation

JICA Guidelines	Mozambican Legislation	Adopted Measure in SLUCP
Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives	There is no provision for this under Mozambican legislation.	The adopted solution minimizes the impacts on livelihood with no involuntary resettlement.
Compensation must be based on the full replacement cost as much as possible. For the purpose of the project, JICA guidelines state that the replacement cost for agricultural land must reflect the market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.	Decree No. 23/2008 states that compensation can be in kind or cash. Although the law requires compensation in market value, compensation is in fact "defined" in the legislation for structures and crops, and any adjustment must be agreed on with the DPA. On the other hand, legislation states that compensation should reflect depreciation of value of structures through age. National legislation does not predict other kinds of assistance beyond compensation.	Agricultural land will be replaced by new land with equal productive potential located as close as possible to the current farmland. Crops will be compensated with market value defined by the DPA. In addition, seeds will be provided. Trees will be replaced (two trees for each tree lost), plus the monetary compensation in accordance with DPA definitions.
Appropriate and accessible grievance mechanisms must be established for the affected people and their communities	National legislation does not specifically require the creation of a grievance mechanism for the affected people, although this is common practice and the role of local leaders in process facilitation and dispute resolution is recognized.	Appropriate and accessible grievance mechanisms will be established for the affected people and their communities

JICA Guidelines	Mozambican Legislation	Adopted Measure in SLUCP
Eligibility of Benefits include the PAPs who have formal legal rights to the land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets, and the PAPs who have no recognizable legal rights to the land they are occupying.	Mozambican law does not specifically states that Tenant have a right to any compensation, although this is common practice.	Compensate tenants for types of losses in production/crops and fruit trees.
Provide support for the transition period (between displacement and livelihood restoration)	There is no provision for other kinds of assistance beyond compensation.	Assistance will be provided specifically to the more vulnerable people.
For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, an abbreviated resettlement plan is to be prepared.	Mozambican legislation requires planning instruments, such as resettlement action plans. However it does not differentiate planning instruments according to the scale and characteristics of displacement.	Only this SLUCP is prepared since no involuntary resettlement is involved for the conduct of even the abbreviated resettlement action plan (ARAP).

1-4-2-3 Extent of Affected Farmlands and PAPs

A summary of lost assets according to type of farmland along with the gender and number of affected household heads and total number of affected PAPs (146 persons) are given below in Table 1-24. The total area of affected farmland is about 10 ha. And inventory of the entire asset loss and its valuation are presented in Appendix-7.

Table 1-24 Number of affected households by type of loss

Type of Loss		Nº of Households Heads	%of Households Heads	No. of PAP	% of PAP
Land user	Male	11	58%	57	39%
	Female	6	32%	68	47%
Land lease holder	Male	0	0%	12	8%
	Female	2	11%	9	6%
Total		19	100%	146	100%

1-4-2-4 Compensation and Assistance

The following categories of project-affected persons (PAPs) were considered as eligible for compensation, amounting to a total of 19 households:

- Owners with traditional rights to agricultural land located inside the project site (both substation and access roads);
- Tenants of agricultural land located inside the project site area;
- Owners of crops located inside the project site area;
- Owners of fruits trees located in the project site area

In this respect the Entitlement Matrix on the provision of compensation for losses incurred by the PAPs is given in Table 1-25.

Table 1-25 Entitlement Matrix of the SLUCP

Item Nº	Type of loss	Entitled Person (Beneficiaries)	Entitlement (compensation Package)	Responsible organization
1	Loss of agricultural land (permanent)	Owners with traditional rights to the agricultural land located inside the project site	Compensation in kind. Replacement land with at least the same size and productivity potential. Assistance in kind: New land preparation, including payment for wages, at market price by employer.	Proponent (EDM) or Subcontracted entity
		Tenants of agricultural land located inside the project site	No compensation for loss of land; Compensation for loss of crops	Proponent (EDM) or Subcontracted entity
2	Loss of cropping areas	Owner of crops located inside the project site	Monetary compensation based on the relevant agriculture crop loss compensation tables as legally determined by the Nampula Provincial Directorate of Agriculture (DPA-Nampula) (The compensation tables could be referred to in Appendix-6). The compensation is based on the current market price and productivity values for various annual and permanent crops. Assistance in kind: Seeds will be provided.	Proponent (EDM) or Subcontracted entity
3	Loss of fruit trees	Owner of fruits trees located in the project site	Monetary compensation based on the relevant fruit tree loss compensation tables provided by the Nampula Provincial Directorate of Agriculture (DPA-Nampula) as referred to above. Replacement trees: For each lost tree, two trees will be replaced.	Proponent (EDM) or Subcontracted entity

In essence, the compensation and livelihood restoration system for the affected 19 small-scale (subsistence) farming and fruit tree-holding households (PAPs) proposed by the SLUCP is composed of the following elements:

- Provision of land for land with the same agricultural potential for all farmland relinquishers with paid labor by the affected farmland relinquishers themselves for the preparation of such new farmlands
- -Monetary compensation for lost crops and fruit trees with each lost fruit tree being replanted with 2 fruit trees (twice replacement for the market price of lost fruit trees)
- Provision of seeds
- Assistance to vulnerable people concerning any of their specific needs on dissemination of information, transportation, logistics, and administration during the implementation of the SLUCP

With the provision of the above compensation and assistance, the livelihood of the 19 affected farming and fruit tree holding households is expected to be retrieved at-least to their living condition prior to the loss of such farmlands and fruit trees.

1-4-2-5 SLUCP Implementation Organization

EDM, as the project proponent and hence the responsible agency, will establish an RU (Relocation Unit) specifically to implement all aspects of the SLUCP including the provision of compensation and the subsequent internal monitoring of the livelihood restoration of the affected farming households. In order to facilitate effective operation of the RU, assistance of an externally hired social expert by EDM as the RU Expert is proposed since the EDM lacks such relocation-oriented social expertise (electricity aspects are its main field of expertise and concern). In addition, external monitoring is also proposed to be conducted on a quarterly basis independent of the internal monitoring by the RU.

It is proposed that the RU of the EDM shall pursue the implementation of the SLUCP in cooperation with the Nampula Provincial Government, the Meconta District Administration, the Nampula Provincial Directorate of Agriculture, the Nampula Provincial Services of Geography and Cadaster, as well as with the Traditional Authority. The proposed SLUCP implementation organization is schematically shown below in Figure 1-16.

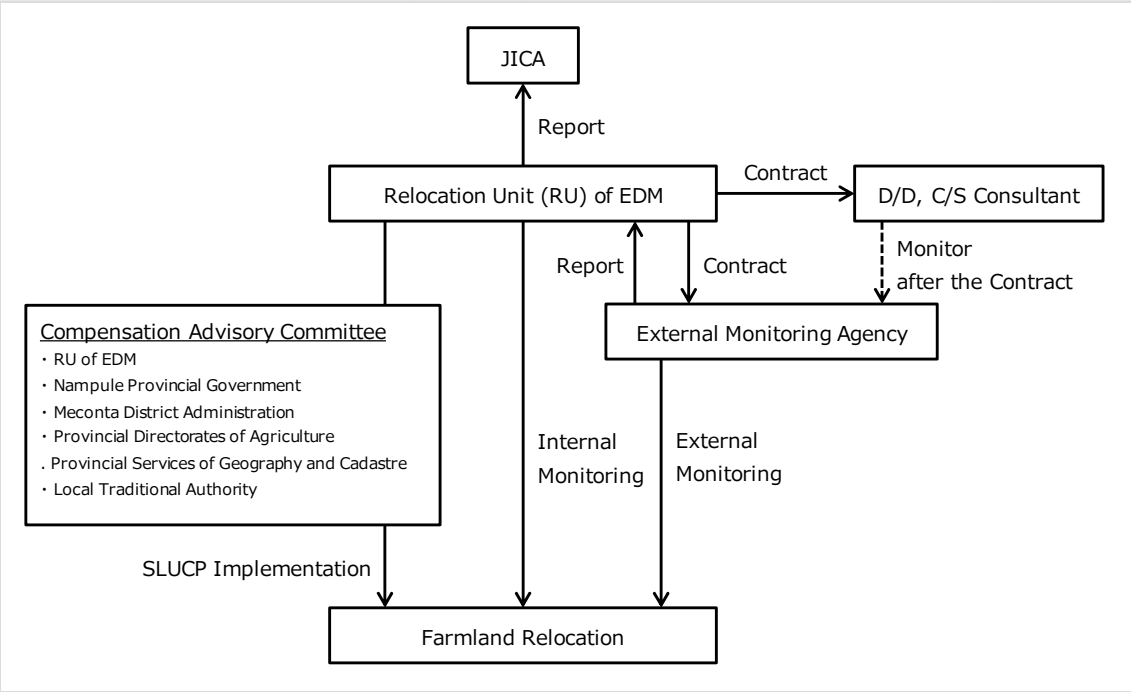


Figure 1-16 SLUCP Implementation Organization

As such, the implementing entity, the RU of the EDM, will set up a Compensation Advisory Committee at the project level to involve the local community in the implementation of the SLUCP. The Compensation Advisory Committee will be comprised of the following members:

- An RU of the EDM representative, as the chairperson
- A Nampula Provincial Government Representative
- A Meconta District Administration Representative
- A Nampula Provincial Directorate of Agriculture Representative
- A Nampula Provincial Services of Geography and Cadastre Representative
- A Local Traditional Authority

1-4-2-6 SLUCP Implementation Schedule

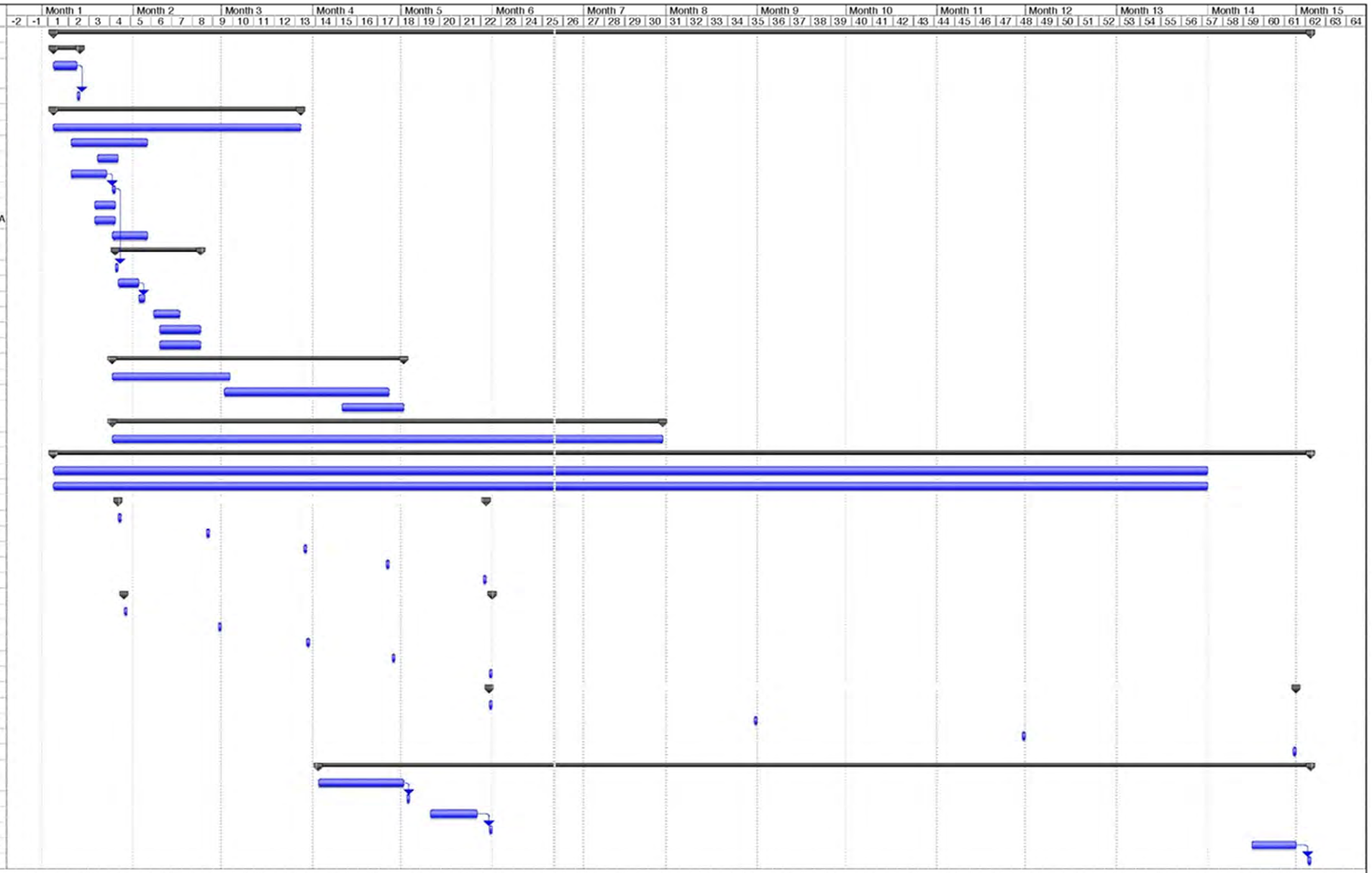
The total timeframe proposed for the implementation and monitoring of the SLUCP is estimated at 14 months, with all farmland acquisition and related compensation aspects to be accomplished within the first 4 months. As such, the last 10 months would involve monitoring livelihood restoration and other related issues, including grievance resolution of affected farming households, if any. In regard to monitoring livelihood restoration, in order to ensure impartiality, service of an external monitoring agency is proposed to be utilized from 1 month after the completion of all farmland acquisition and

related compensation provisions (from the 5th month after the commencement of the SLUCP implementation). This external monitoring is proposed to be conducted on a quarterly basis (once in every 3 months) until the completion of all monitoring activities (expected to be by the end of the 14th month, which would result in 4 external monitoring visits).

Moreover, since the entire implementation of the SLUCP needs to be accomplished within a time frame of 14 months, it could also be accomplished within the preconstruction phase of the project (during the detailed engineering phase) and hence before the commencement of construction work.

The proposed implementation schedule of the SLUCP is shown in Figure 1-17.

ID	Task Name
1	**SLUCP Implementation**
2	**Coordination and Mobilization**
3	Communication with Local Authorities and set up Compensation Advisory Committee
4	Preliminary meeting
5	**Pre-Planning**
6	Update SLUCP database
7	Identify displacement farmland
8	Submit necessary applications for reallocation land
9	Prepare SLUCP information for dissemination
10	Consultation with PAPs
11	Procurement for service provider
12	Procurement for External Monitoring and Evaluation A
13	Publish SLUCP Grievance procedures
14	**Monetary Compensation**
15	Signature of the compensation agreements
16	Identify PAPs who need bank accounts opening
17	Opening bank accounts
18	Compensation payments
19	Follow up of Bank Transfers and notify PAPs
20	Notify PAPs of the vacation conditions
21	**Displacement**
22	Preparation of the new farmland
23	In kind assistance for new farmland
24	Displacement
25	**Grievance resolution Mechanism**
26	Grievance redress
27	**Monitoring and Evaluation**
28	Update SLUCP database
29	Assessment of monitoring indicators data
30	**Compensation Advisory Committee Meeting**
31	Compensation Advisory Committee Meeting 1
32	Compensation Advisory Committee Meeting 2
33	Compensation Advisory Committee Meeting 3
34	Compensation Advisory Committee Meeting 4
35	Compensation Advisory Committee Meeting 5
36	**EDM monthly progress report**
37	EDM monthly progress report 1
38	EDM monthly progress report 2
39	EDM monthly progress report 3
40	EDM monthly progress report 4
41	EDM monthly progress report 5
42	**External monitoring and evaluation**
43	External monitoring and evaluation 1
44	External monitoring and evaluation 2
45	External monitoring and evaluation 3
46	External monitoring and evaluation 4
47	**SLUCP Completion**
48	Preparation of SLUCP Draft Report
49	SLUCP Draft Report
50	Preparation of SLUCP Completion Report
51	SLUCP Completion Report
52	Preparation of Final SLUCP Completion Report
53	Final SLUCP Completion Report



Project: Timetable
Date: Thu 1/22/15

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 1

Figure 1-17 Proposed SLUCP Implementation Schedule

1-4-2-7 Grievance Redress System

With respect to the redress of any grievance in the provision of compensation and related assistance to the affected farming households, a hierarchy-based grievance redress system is proposed, starting with traditional authorities followed by a compensation advisory committee, provincial government, and court of law as the final redress authority. The proposed grievance redress system is schematically illustrated below in Figure 1-18.

As per the grievance redress system shown in Figure 1-18, at first grievance of a PAP should be solved at the local level with the assistance of traditional authorities (traditional leaders). The aggrieved PAP can address the complaint in writing or verbally. The traditional leaders shall resolve the dispute within 7 days.

If the aggrieved PAP is not satisfied with the decision taken by the traditional leaders or when disputes cannot be solved at this level by the traditional leaders, the PAP shall report the complaint to the Compensation Advisory Committee. The complaint can be submitted by filing a grievance registration form. If the complainant PAP requires assistance to formalize the writing of the complaint, either the traditional leaders or the RU of the EDM shall provide such assistance.

The Compensation Advisory Committee will propose a resolution to the grievance and communicate it to the PAP within 10 days after the decision by the committee. The Compensation Advisory Committee will communicate the resolution to the aggrieved PAP in writing by filing the Complaint Resolution Form.

When conflicts cannot be resolved informally at the Project level even by the Compensation Advisory Committee, formal mechanisms will be required. The Provincial Government can be referred to as the initial form of a formal mechanism for dispute resolution. Decisions by the Provincial Government can be subject to appeals in the Court of Law of Mozambique.

Finally, it is emphasized that the RU of the EDM must keep a record of the entire grievance redress process, taking note of the grievances presented by the PAPs, the responses to them, and the agreements reached.

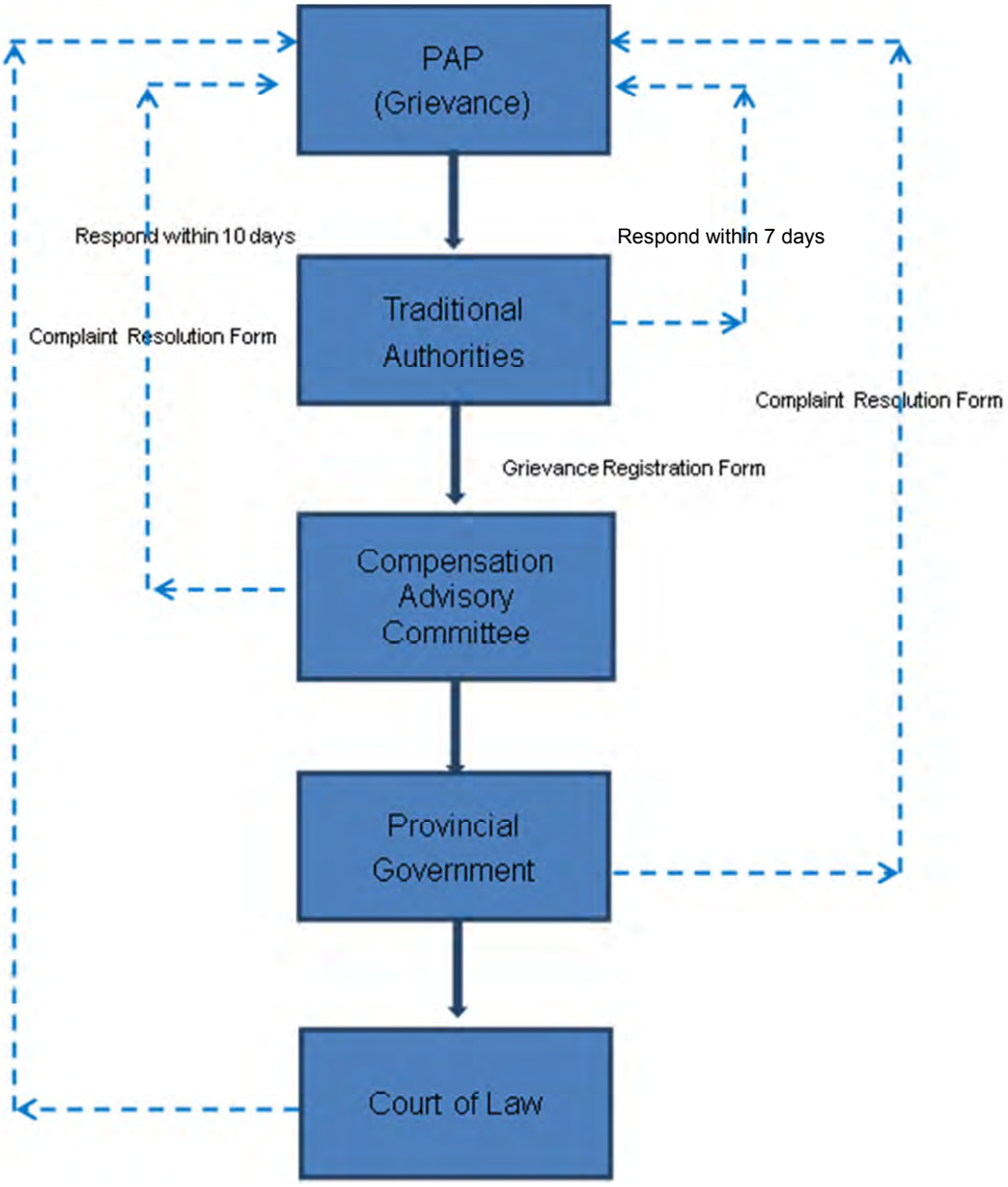


Figure 1-18 Grievance Redress System

1-4-2-8 Budget for SLUCP Implementation

The estimated total budget for the implementation of the SLUCP is MZN 1,337,515.00 (Mozambican New Meticais). The breakdown of the cost estimation is summarized below in Table 1-26.

Table 1-26 Summary of the estimated budget for the SLUCP

Item	Total Cost (MZN)
Compensation	
Crops	151,015.00
Fruit Trees	403,500.00
Assistance	
Assistance in-kind for new land preparation	100,000.00
Assistance in-kind by providing seeds	3,000.00
Replacement trees	10,000.00
Assistance to vulnerable persons	20,000.00
Relocation Unit	500,000.00
External monitoring agency	150,000.00
Total	**1,337,515.00**

1-4-2-9 SLUCP Monitoring

Conduct of both internal and external monitoring is proposed as noted under the item on the implementation schedule of the SLUCP above. The RU of the EDM, the representative agency of the project proponent responsible for the conduct of all aspects concerning the implementation of the SLUCP, will conduct internal monitoring. The external monitoring will be conducted by an external agency hired by the RU of the EDM and is expected to be conducted 4 times during the total SLUCP implementation period of 14 months (5^{th}, 8^{th}, 11^{th}, and 14^{th} months) as also noted above under the same item on the implementation schedule of the SLUCP.

The relevant SLUCP monitoring forms to facilitate the conduct of both the internal and external monitoring are presented respectively in Appendix-8 (the monthly progress monitoring form for internal monitoring by the RU of the EDM), Appendix-9 (the activities monitoring form for external monitoring), and Appendix-10 (the indicator–wise monitoring results form for both internal and external monitoring).

1-4-3 Environmental Checklist

With due consideration to the SES/EIA and SLUCP aspects of the ESCS described in the previous sections of 1-4-1 and 1-4-2, the environmental checklist was formulated for the Namialo SS Project, using the power transmission and distribution sector checklist from JICA. The completed environmental checklist is given in Appendix-11.

Furthermore, it is pointed out that concerning environmental monitoring, in essence, no significant long-term monitoring (the operational stage of project) is regarded as necessary with the provision of a buffer zone (green area) around the Namialo SS as the long-term effective mitigation measure against any potential noise and vibration effects related to the operation of the SS (as also noted in the environmental checklist). Moreover, the relevant overall environmental monitoring plan and monitoring form aspects could be referred to in Section 1-4-1-10.

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Objective of the Project

1) National and Regional Plan

In the "The Poverty Reduction Action Plan (2011-2014)" (PARP), the Government of Mozambique (hereafter GOM) considers that the lack of basic infrastructure such as electric power services is the major reason of poverty in rural farm villages as well as the urban fringe, and therefore the improvement of the infrastructure in such areas is very important. And also this project is in line with the power sector master plan proposed in 2004, which contains 400kV of new transmission lines and a new substation at Namialo in the Northern grid.

The said power sector master plan of Mozambique, which was updated and approved by the EDM in 2014, estimates that the power demand of Mozambique will reach 3,696 MW and the amount of the power supply will reach 22,753 GWh in 2026, and the power demand will continually increase at an annual growth rate of 12.5% from 2011 to 2026. Especially, the demand growth of the Northern grid is estimated at 13.5%, which is higher than the figures estimated for the Central grid (11%) and the Southern grid (12.7%). It means that the Northern grid needs more rapid power development.

In order to meet this power demand rapidly increasing in the Northern area, the Master Plan recommends the following project plans:

- Chimuara-Nacala transmission project (Chimuara-Alto Molocue-Namialo)
- 220 kV transmission enforcement project (Nampula-Namialo-Evate-Nacala Velha and Namialo-Metoro)
- Construction of new substations along these new transmission lines

The new Namialo substation of this project will be connected to 400 kV and 220 kV lines in the future and become one of the most important substations in the Northern grid.

Furthermore, the master plan estimates that the electrification ratio will reach 25% in 2016 with the expectation of annual connections to electricity services from 80,000 ~ 100,000 households that consequently improves the electrification ratio by 6 points from 2011 to 2016 and expects the electrification ratio to be 35% in 2027 at the best case scenario.

In order to achieve these targets for electrification, some projects such as a voltage upgrade of the distribution network from 11 kV to 33 kV, reinforcement of the distribution network, and construction of new substations are planned.

2) Objective of the Project

This project is to construct a new substation at Namialo in the Meconta district and to reinforce the existing substations in the Nampula district in order to provide a stable power supply in the Northern grid, which faces rapid growth of power demand. Therefore, this project will contribute to the improvement of human life and the encouragement of economic activities in the Northern region.

A new Namialo substation is one of the most important stations for the Northern power system because the future 400 kV transmission lines and 220 kV lines will be connected to this substation and it will also work as the interconnection point for all existing 110 kV lines.

A new Namialo substation is capable not only of the interconnection of existing 110 kV lines but also for the expansion of a future 110 kV bay to be connected with a 400 kV/110 kV transformer in order to improve Northern power system reliability. Another function of this substation is to supply electricity to the local communities by installing a 110 kV/33 kV transformer, which will therefore contribute to the local electrification of the Namialo area along the Nacala Corridor.

(2) Outline of the Project

In consideration of the objectives of the project mentioned above, this project is outlined below:

A new Namialo substation will be constructed and connected to existing 110 kV double lines. It includes all necessary 110 kV switchgears, a 110 kV/33 kV transformer, and 33kV feeder circuits. A 110 kV bus bar, of which the configuration is designed as a double-bus type to improve the service reliability, keeps expansion space for a future 400 kV/110 kV transformer connection.

3 sets of Mini SCADA (Supervisory Control And Data Acquisition) will be installed at Nampula Central, Nampula 220, and the new Namialo substation in order to:

- Improve operation security
- Reduce the workload of operators
- Contribute to the substation statistical load analysis

2 circuits of PLC (Power Line Carrier) telecommunication will also be provided to exchange supervisory and control data between the mini-SCADAs.

Three sets of 33 kV/400 V distribution transformers will be provided for the improvement of local electrification in the area surrounding Namialo.

This project is composed of the following main components.

1) A new Namialo Substation
2) New transmission towers for drawing power lines to the Namialo substation
3) A new distribution line supplied from the Namialo substation

4) A new SCADA system including PLC communication devices for 2 circuits (between Nampula Central, Nampula 220, and the Namialo substation)
5) New distribution transformers including installation and connection works with distribution lines for non-electrified communities

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The GOM points out in the "The Poverty Reduction Action Plan (2011-2014)" (PARP) that poor infrastructure, including a lack of electric power services, may cause poverty in both rural farm villages and urban neighboring areas. Therefore, the GOM sets their priority to improve the infrastructure of a region with high potential for economic development in a high-poverty area.

The Japanese Government has a policy to develop local economic activities including the Nacala corridor as their most important field for assistance to Mozambique and therefore encourages the "Nacala corridor development and infrastructure programme" which is one of the most important projects in Mozambique.

It is another important policy to promote sustainable economic development, which is emphasized by the Tokyo International Conference on African Development V (TICAD V).

Under these circumstances, the GOM requested a "Reinforcement plan for the transmission line at Nacala corridor" (hereafter "the project"); this project is consistent with the Master Plan of 2004 and the Nampula-Monapo distribution enforcement plan.

The main component of the project is to construct a new Namialo substation at a location between Nampula and Nacala city which is a suitable site for a new substation because the Nampula-Nacala transmission line and the Nampula-Northern Metoro line intersect at this point. When these lines are connected to the new substation, the Nampula-Namialo transmission system will be reinforced with double circuits and expanded to have more transfer capacity. The Namialo substation can also contribute to the improvement of a distribution capacity in the Namialo area and improve the power supply reliability along the Nacala corridor.

(2) Natural Conditions

The following climate conditions and environmental effects are provided in the feasibility study for the Chimuara-Nacala Transmission Project, and the same shall be applied for this project in order to unify the design criteria.

Climate Conditions

Temperature

・Maximum	: 50 ℃
・Minimum	: 0 ℃
Rainy season	: Rain from November to April
Rainfall yearly	: 400-1,700 mm
Rainy days per year	: (>1mm) approximately 100
Thunderstorms	: 60-70 per year
Maximum solar radiation	: 1,200 W/m2
Wind speed max	: 40 m/s
Design wind pressure	: 1,100 Pa
Humidity - maximum	: 100 %

Environmental Effects

Altitude	: 0-1,000 m above sea level
Pollution level	: IV according to IEC 60071
Seismic coefficient	: 0.2 g

(3) Design Policy for Substation and Transmission Tower

The substation and transmission tower are designed according to the design specifications and technical references of the EDM listed below.

1) Substation specifications and references

- Reinforcement and Extension of the National Power Transmission Grid
  Part3-Standard Specifications-Transmission Substations
- Guidelines of the Relay Protection System EDM
- Chimuara-Nacala Transmission Project - FS

2) Transmission Tower specifications and references

- Reinforcement and Extension of the National Power Transmission Grid
  Part3-Standard Specifications-Transmission Lines
- Chimuara-Nacala Transmission Project - FS

3) SCADA system references

- National Control Center and Northern, Central-Northern, Central Regions Control Centers Project - Feasibility Study Report

4) Distribution Transformer specification

- Design Manual-Distribution Networks EDM

(4) Local Procurement Conditions

Work related to the installation of equipment is roughly divided into two portions below:

- Installation of equipment
- Construction of associated facilities such as Foundations for equipment, a Control Building and a Guard House

For the installation of equipment, a local contractor who supplies skilled workers will be utilized, and Japanese supervisors who are well experienced in installation, commissioning, and testing for substation equipment will be stationed to supervise the local contractor's work.

It is considered that the associated facilities, said foundations and buildings, can be constructed by a local contractor who is experienced in normal civil and building works; one experienced Japanese civil and building engineer will be stationed there to supervise the local contractor's works.

As for building codes, the Portuguese code is generally used in Mozambique; however, the equivalent international code such as BS, EN, AISC, JASS, etc., that Japanese engineers are familiar with should be applied for this project.

(5) Operation and Maintenance

1) Organization, budget and human resources

The EDM is the nation-wide power utility that operates power generation facilities and provides electric power transmission to domestic customers. It properly manages, operates, and maintains those power facilities.

However, the EDM seems to not be able to afford an adequate budget for O&M expenses and some repairs, and an overhaul may take some time due to its restricted budget allocation. However, the EDM generally manages to maintain and repair defective equipment at acceptable level.

It is confirmed that the EDM can secure the necessary human resources for substation maintenance, operation, and management.

2) Technical capability

The EDM has a design policy that all substation equipment shall be installed on the basis of air insulation and therefore their own O&M staff can repair most failures. It is considered that the EDM's technical strength is capable for the required O&M.

3) O&M resources for the project

It is confirmed that the EDM will assign 9 operation staff members for the new Namialo substation after its commissioning; it will be operated around the clock by 4 shifts (2 staff members per shift). Operators are responsible for daily substation management and in cases of serious trouble; 4 substation maintenance staff members from the Nampula Central substation will carry out repairs.

Hence, it is an appropriate judgment that the EDM can continuously manage and maintain the new Namialo substation O&M activities after its handover.

(6) Grade of Equipment and Facilities

1) Equipment

The substation is designed with an air-insulation switchgear (AIS), which complies with the EDM's substation design standards and is suitable for sustainable maintenance by the EDM's personnel. A double bus bar type is applied because of the importance of this substation as a hub station in the grid.

Specifications for the main substation equipment are defined by two types of standards.

The first one is a Japanese technical standard from the JEC (Japanese Electrotechnical Committee), for a 110 kV SF6 Gas CB and 110 kV/33 kV main transformer which are made by Japanese manufacturers and have technical advantages in reliability due to its important functions in the substation.

The second is an international standard from the IEC (International Electrotechnical Commission) for general equipment such as a 110 kV disconnector, protective relay, and a 33 kV switchgear widely supplied at reasonable prices by third country manufacturers in order to reduce the project budget.

The Japanese dead-tank type Gas CB has a high reliability; its failure rate is less than one-third of a live-tank type CB's rate which is mainly supplied by overseas manufacturers.

The Japanese transformer is also more reliable than overseas products and its major failure rate is just 0.09%/unit per year which is one-sixth the rate in comparison with an overseas one.

Transmission towers connected to the substation are designed as tension type because the existing suspension-type towers are not capable of withstanding the unbalance of a wire tension load.

New towers are designed based on the transmission lines standards of EDM.

SCADA system at 3 sites is designed with the following composition based on EDM national control strategy.

- Nampula Central substation: Host control center
- Nampula 220 and Namialo substations: terminal stations

Data protocol of the SCADA system is specified to be IEC 60870-5-101/104, which is a global standard protocol that can afford the expansion of the SCADA system to be connected with the Northern National Control Center in the future. Telecommunication for the SCADA data exchange is installed with 2 circuits of PLC line between those substations.

3 circuits of the PLC between Namialo and the existing substations (Nampula 220-Namialo, Namialo-Monapo, and Namialo-Metoro) are excluded from the project scope since it is not required for the SCADA system as well as limitations of the project budget.

Distribution transformers are composed of 2 sets of 160 kVA and 1 set of 250 kVA whose ratings comply with the EDM standard capacity.

2) Facilities

For the operation of a new Namialo substation, the following two buildings are required and designed.

- Control Building
- Guard House

As mentioned in the above section (4), a local contractor will be utilized for the construction of these buildings. Therefore, the general RC (reinforced concrete) structure that can be locally constructed by the conventional method is adopted for these buildings.

Also for the selection of finishing materials as well as air conditioning equipment, the materials and equipment that are normally used for general buildings in Mozambique will be adopted.

(7) Method of Procurement & Construction and Project Duration

1) Equipment

The procurement policy for equipment is defined as follows for the substation, transmission tower, and distribution transformer.

a) The following main substation equipment is specified to comply with JEC standards due to the technical expertise of Japanese manufacturers and the requirement of a high reliability for them.

- 110kV SF6 Gas CB of dead-tank type
- 110kV/33kV 40MVA Main Transformer

And the Japanese manufacturer will also supply the SCADA system due to its technical expertise and potential for expansion into the Mozambique power sector.

b) Other equipment listed below is specified to comply with the IEC and/or the International Standard to afford the benefits of cost-competitive products supplied by third country manufacturers as much as possible.

- 110 kV Disconnector, CT, VT Surge Arrester, 110 kV busbar, Conductor and Steel Structure
- 33 kV Distribution Switchgear, Power Cable, Conductor
- Protective Relay, Switching Board, Control Cable, and Metering Device
- Substation In-house Load, Emergency Generator, Battery, and auxiliary facilities
- PLC, including a Line Trap device
- New Transmission Tower and Temporary Tower
- Distribution Transformer for the electrification of communities
- Other necessary materials

2) Construction Method and Project Duration

For the installation of equipment and the construction of facilities, no special method is required except for the inland transportation of the main transformer whose weight is approximately 50 tonnes. Details are described in Section 2-2-4-2 (1).

For the planning of the project schedule, the earthwork and construction of foundations should be planned during the dry season. The rainy season in the Nampula region is from November to April.

2-2-2 Basic Plan (Equipment Plan/Construction Plan)

The GOM initially requested the following project consisting of these major components from Japanese government:

1) Construction of the Namialo substation
2) Rehabilitation of the Nampula Central substation switching board
3) SCADA system for the Namialo, Nampula Central and Nampula 220 substations

Subsequently, during this preparatory survey in Mozambique, the EDM found that the following additional components are needed for the project:

4) PLC (power line carrier) communication devices
5) A tension-type transmission tower
6) An EG (emergency generator) for the Namialo substation
7) A substation control building
8) Provision of distribution transformers to non-electrified communities along the Nacala corridor (*this component is proposed by the JICA side.)

However, after the cost examination of the project including all items mentioned above, it was found that it exceeds the project budget; consequently, the rearrangement of the project components is required.

In consideration of the importance of the Namialo substation and the effectiveness and potential of the SCADA system in the Northern grid, the project components are finally revised as below:

1) Construction of the Namialo substation with AIS type, double busbar and 110 kV/33 kV transformer, etc.
2) A tension-type transmission tower
3) A Namialo substation control building
4) An EG (emergency generator) for the Namialo substation
5) 3 sets of the SCADA system applied to the Nampula Central, Nampula 200, and Namialo substations
6) PLC telecommunication lines of 2 circuits between Nampula Central-Nampula 220 and Nampula Central-Namialo
7) Provision of distribution transformers to non-electrified communities

Rehabilitation of the Nampula Central substation switching board is excluded from the project due to not only budgetary limitations but also high technical risk of rehabilitation work and the necessity of detailed investigation work on the existing control circuit connection. Therefore, rehabilitation of the Nampula Central substation switching board is recommended to be carried out by the EDM.

2-2-2-1 Entire Plan

2-2-2-1-1 New Namialo Substation

The Namialo area is located 80 km east of Nampula city, the third largest city in Mozambique. The Namialo substation is located in the area of Namialo along the Nacala corridor, as shown in Figure 2-1. The Namialo substation site is the exact intersecting point of the following existing 110 kV transmission lines:

- Nampula Central-Monapo (C32)
- Nampula 220-Metoro (C35)

The project site is 1.5 km from the Nacala corridor road (EN12), and most of the site is under supervision by the EDM. The overall view of the Namialo substation construction site is shown in Figure 2-2.

The Namialo substation is connected to the C35 and C32 transmission lines as a power supply line. And then, the substation improves the power supply reliability for the north side of the Metro substation and the east side of the Monapo substation. Furthermore, expansion of the distribution network, and consequently the improvement of the electrification ratio in the Namialo and Meconta areas, is expected by installing a 110 kV/33 kV 40 MVA transformer.

Since the Namialo substation is one of the most important key stations in the Northern grid and is planned connect to 400 kV lines in the future, it is designed with a double busbar and AIS type. It is also equipped with 2 incoming and 2 outgoing lines, and a 110 kV/33 kV transformer of 40 MVA×1 bank which supplies power to Namialo communities through 33 kV distribution lines.

As the Namialo substation will be connected to 400 kV lines in the future, expansion bay space is reserved for a 400 kV/110 kV transformer connection.

A substation control building is designed for a 110 kV switching board and 33 kV indoor switch-gear.

The Northern grid is far away from its power source, the Cahora Bassa Hydro-power Plant, and experiences serious blackouts of more than 5~6 hours caused by transmission line trouble and/or machine failures. Therefore, in order to ensure sufficient emergent power supply reliability, the substation is equipped with not only a battery but also an emergency generator.

It should be noted that, prior to the commencement of construction for the new Namiaro substation, it is necessary to prepare a temporary access road for the construction activities from the national highway (EN12) to the project site of the Namialo substation.

Figure 2-1 Location of the Namialo substation site

Figure 2-2 Overall view of the Namialo substation construction site

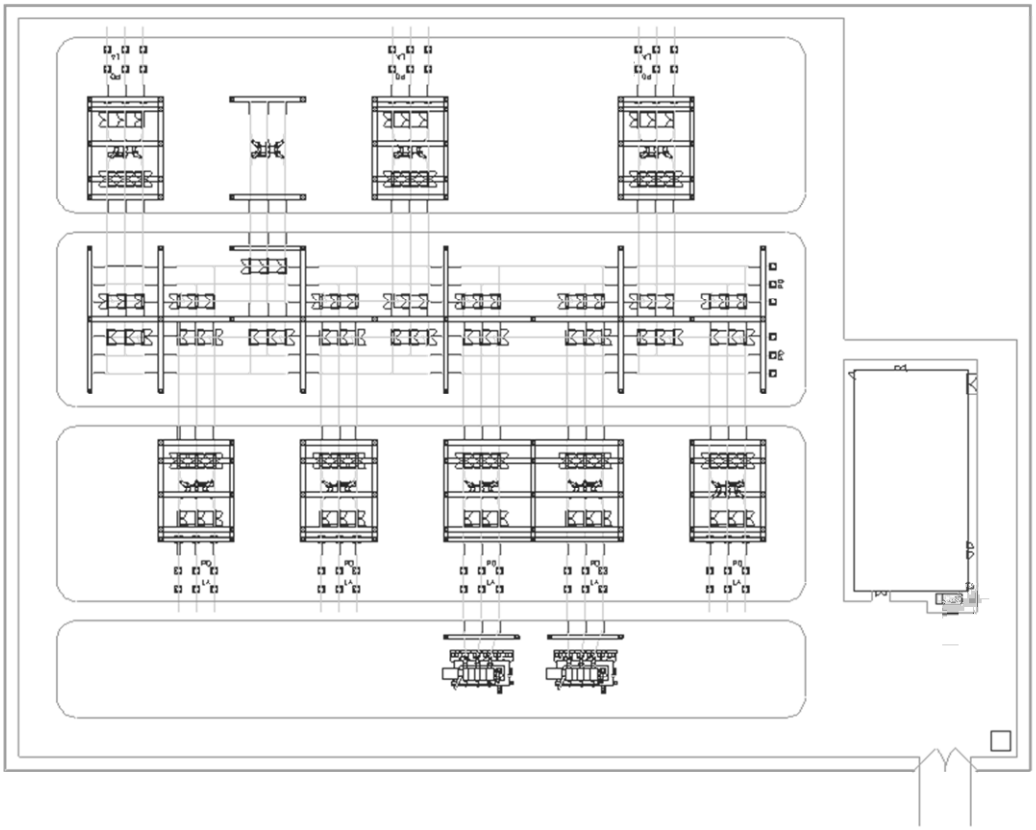


Figure 2-3 Equipment Layout Plan for Namialo Substation

2-2-2-1-2 New Transmission Towers

The nearest transmission tower to the substation is a suspension type; therefore, new tension-type towers will be constructed as shown in Figure 2-4.

Since the new Namialo substation will be constructed right beneath the existing transmission lines, it is difficult to keep a safe distance with live lines for the use of heavy machinery such as excavators and cranes, and it may cause a serious incident. In order to avoid such risks, the existing transmission lines should be detoured to avoid the construction site by constructing a tentative tension tower as shown in Figure 2-5. Then, the transmission lines will be finally connected to the Namialo substation as shown in Figure 2-6.

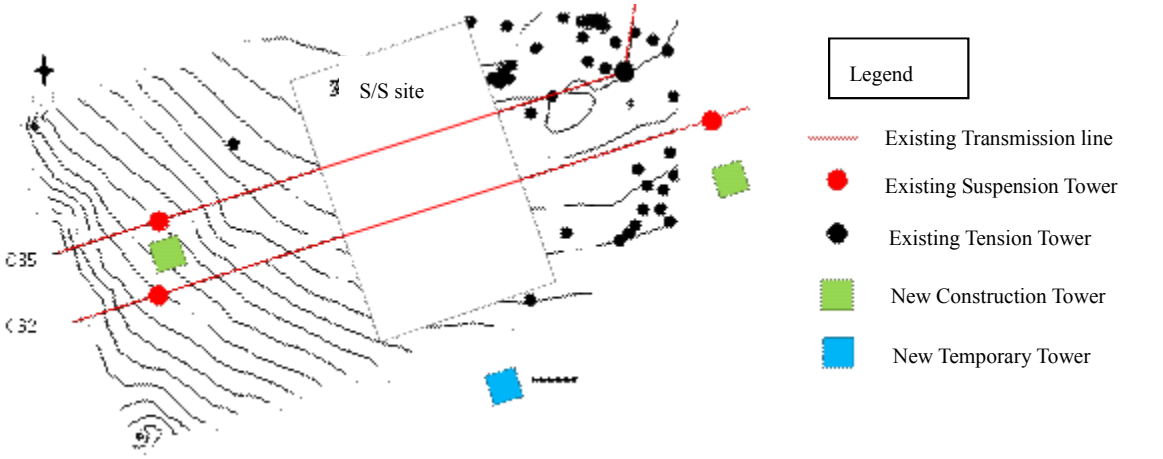


Figure 2-4　Location of the Namialo substation, new towers and tentative tower

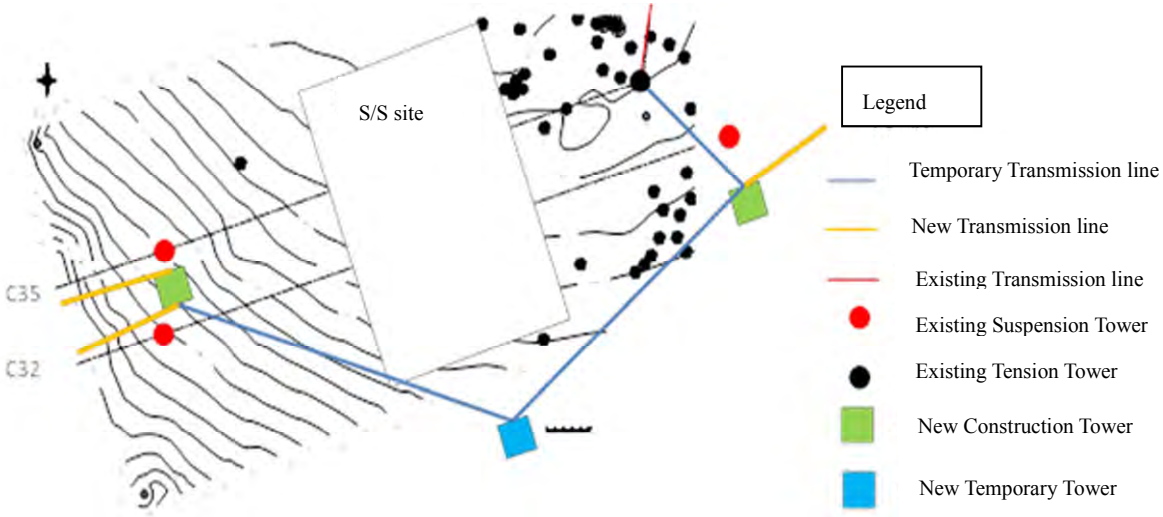


Figure 2-5　Transmission detour route during Namialo substation construction

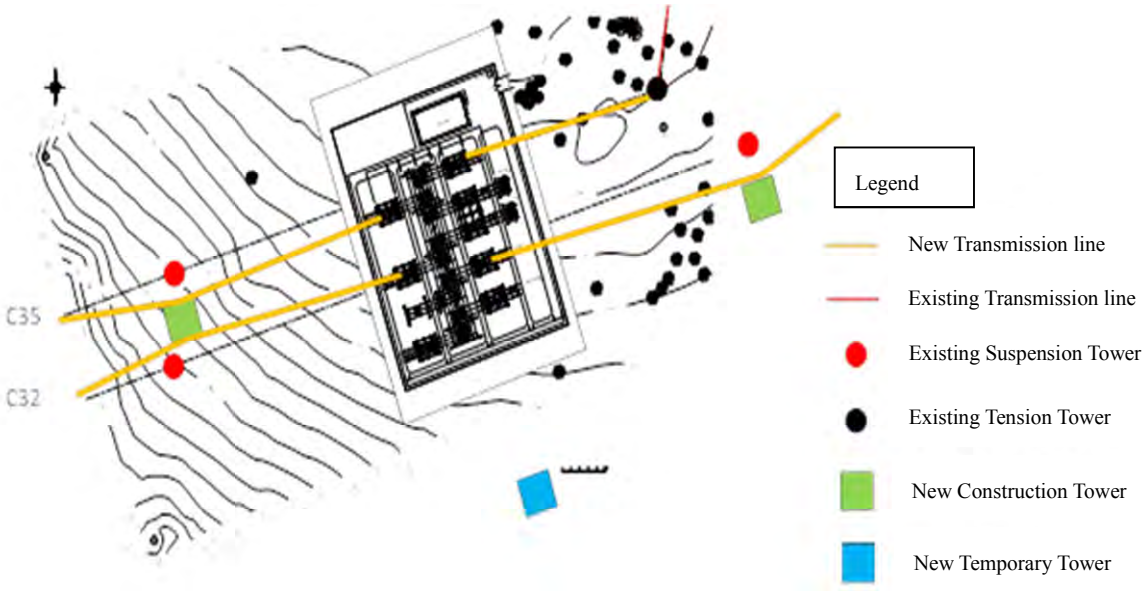


Figure 2-6 Transmission final routes after Namialo substation commissioning

Basic designs of tension type towers are shown in

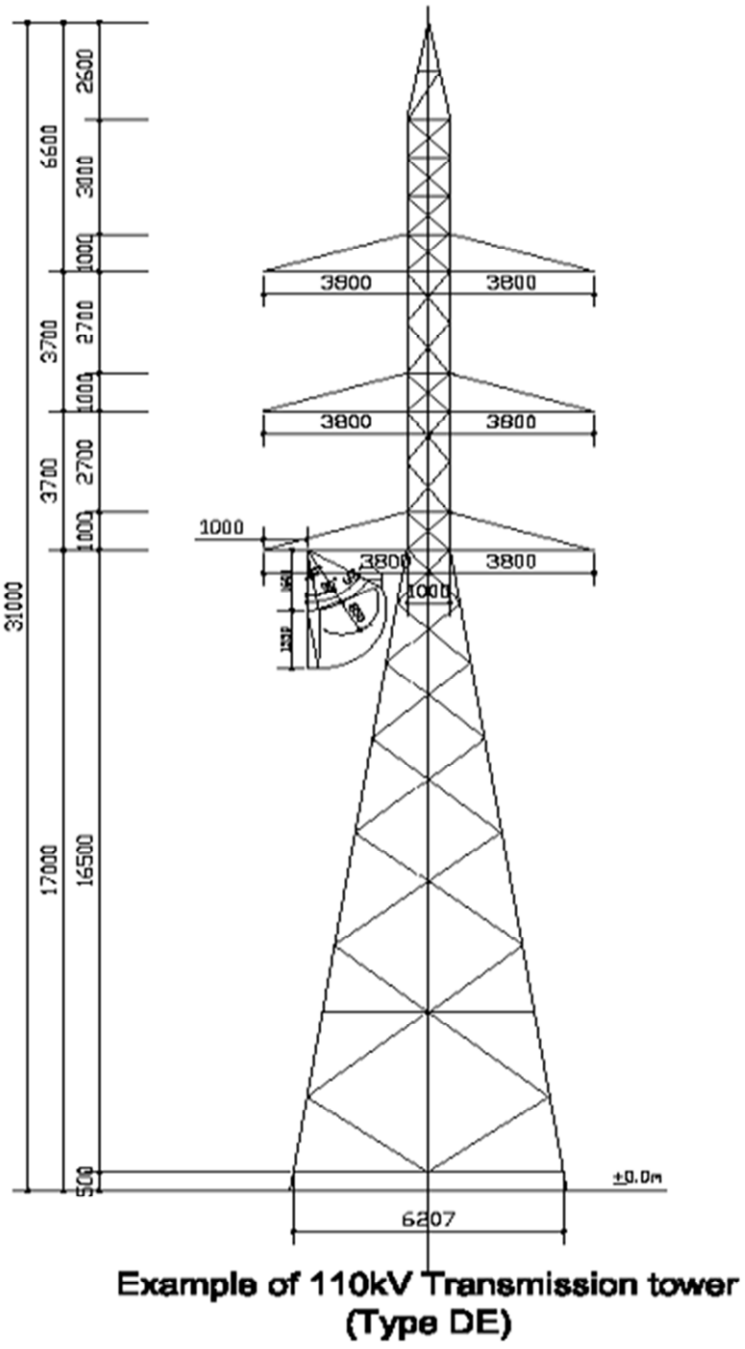
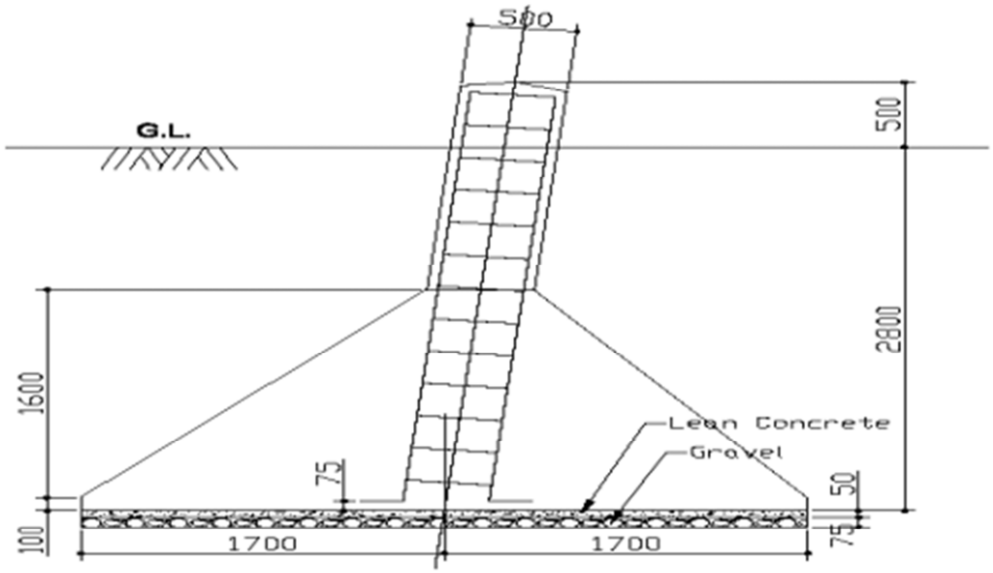


Figure 2-7 Configuration of New Tension-type Tower



Example of 110kV Tower Foundation
(Type – Dead End)

Figure 2-8 Foundation of New Tension-type Tower

2-2-2-1-3 New Distribution Lines from the Namialo Substation to Existing Lines

Four 33 kV distribution lines from the Namialo substation to the existing distribution lines will be constructed. Two rows of concrete poles will support four lines, and the length of these lines varies from 1.5 km to 2 km.

Routes of existing distribution lines are shown in Figure 2-9.

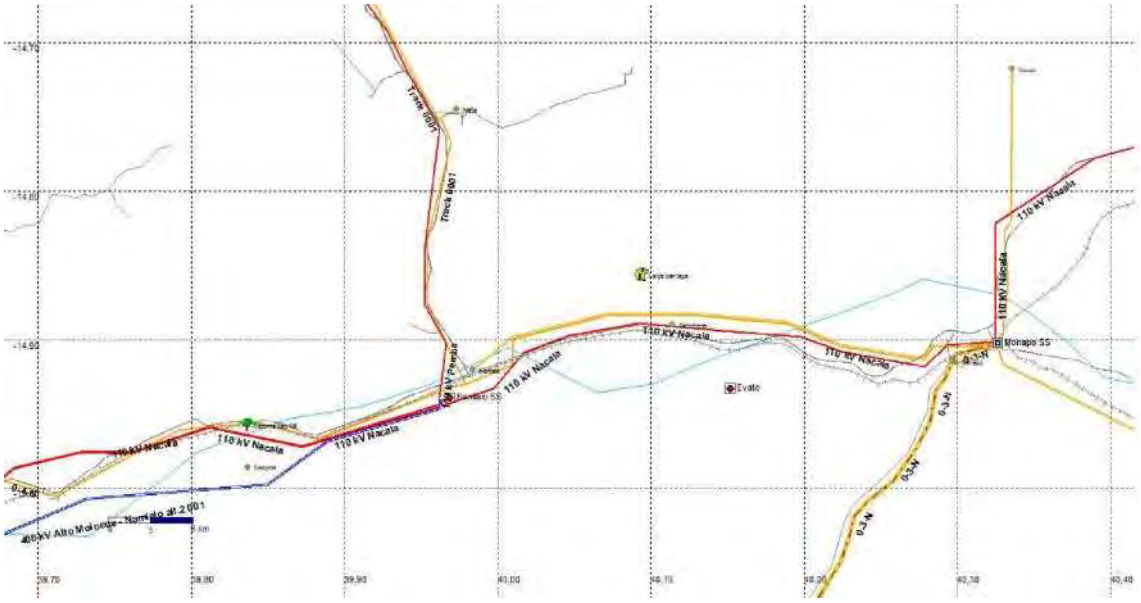


Figure 2-9 Routes of the existing distribution lines near Namialo substation

Outline of the four 33kV distribution lines supplied from the Nampula substation is shown in Figure 2-10.

Four distribution lines will be newly constructed. Two distribution lines are for the Monapo area, one distribution line is for the Metro area, and another for the Meconta area. Details of each line are as follows:

1) Namialo substation ~ Monapo area (Distribution line A)

Distribution line A will be connected with existing distribution line located on the south side of EN12. It is used as a distribution line for supplying power to the Monapo area.

- 33kV overhead distribution lines: 1,500m, Wire: AAAC 150 mm^2
- Concrete poles for 33kV distribution lines: 20 poles
- 33kV underground cable: 100 m

2) Namialo substation ~ Monapo area (Distribution line B)

Distribution line B will be connected to the existing distribution line located on the north side of EN12. It is used as a distribution line for supplying power to the Monapo area.

- 33kV overhead distribution lines: 2,000m, Wire: AAAC 150 mm^2
- Concrete poles for 33kV distribution lines: 27 poles
- 33kV underground cable: 100 m

3) Namialo substation ~ Metro area (Distribution line C)

Distribution line C will be connected to the existing distribution line located on the south side of EN12. It is used as a distribution line for supplying power to the Metro area.

- 33kV overhead distribution lines:1,500m, Wire: AAAC 150 mm^2
- Concrete poles for 33kV distribution lines: 20 poles
- 33kV underground cable: 100 m

4) Namialo substation ~ Meconta area (Distribution line D)

Distribution line D is connected to the existing distribution line located on the south side of the EN12. It is used as a distribution line for supplying power to the Meconta area.

- 33kV overhead distribution lines: 1,500m, Wire: AAAC 150 mm^2
- Concrete poles for 33kV distribution lines: 20 poles
- 33kV underground cable: 100 m

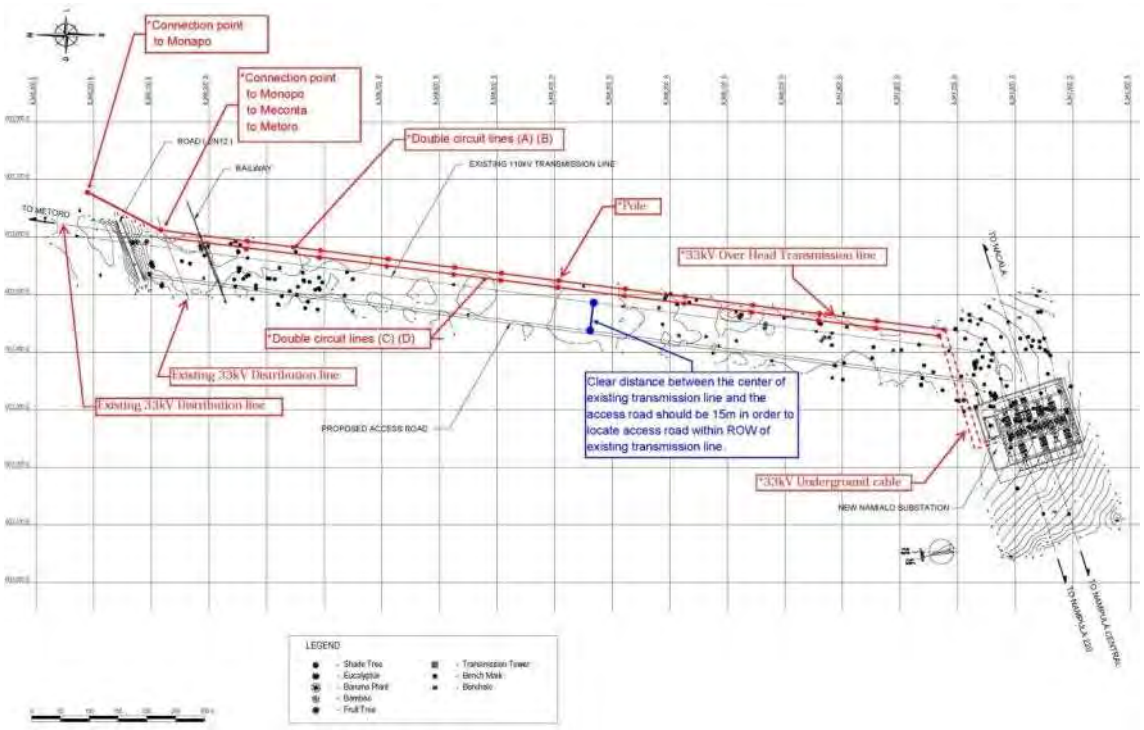


Figure 2-10 Construction overview of 33kV distribution lines supplied from the Namialo substation

One of the four distribution lines will be used as a temporary power supply line for the construction work at the Namialo site. Therefore, one distribution line shall be constructed prior to the commencement of the Namialo substation construction work.

2-2-2-1-4 SCADA system

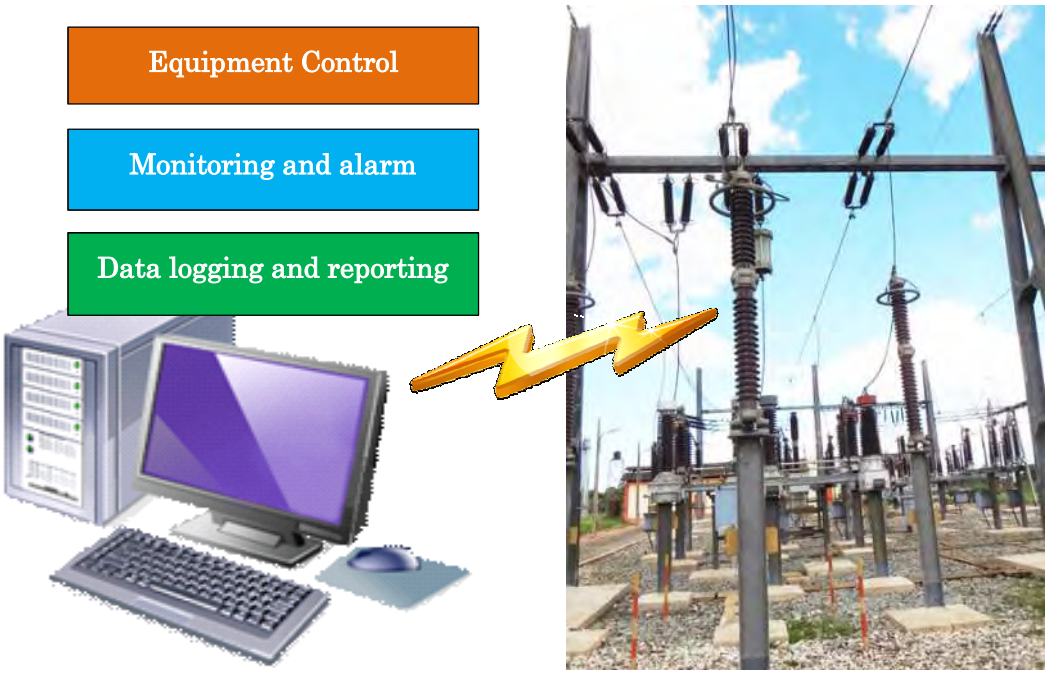


Figure 2-11 Conceptual diagram of SCADA system

According to the EDM's basic scheme of the national grid control center, the SCADA system is designed for the following three substations:

- Nampula Central substation
  Existing substation where the host control center is designed
- Nampula 220
  Existing substation where a terminal station is designed
- Namialo substation
  New substation where a terminal station is designed

Communication protocol is based on the international standard, IEC 60870-5-101/104, so that it can be linked with the Northern grid control center system in the future.

The host control center is designed at the Nampula Central substation which is the base for the main maintenance works in the Northern grid; it is capable of monitoring and controlling the Nampula 220

and Namialo substations through the terminal stations. For data transmission between the SCADA systems, the PLC will be installed. The PLC utilizes the existing transmission lines as telecommunication lines between the host control center and terminal stations.

Overall configuration diagram of the SCADA system and PLC communication apparatus are shown in Figure 2-12.

The SCADA system has the functions shown in Table 2-1, and will contribute to the reduction of the operational and recording workload at substations. It also allows engineers to implement a detailed accident analysis of power outages. As a result, it is expected to reduce outage times. In addition, introducing the SCADA system enables the accumulation of data that contributes to power system planning.

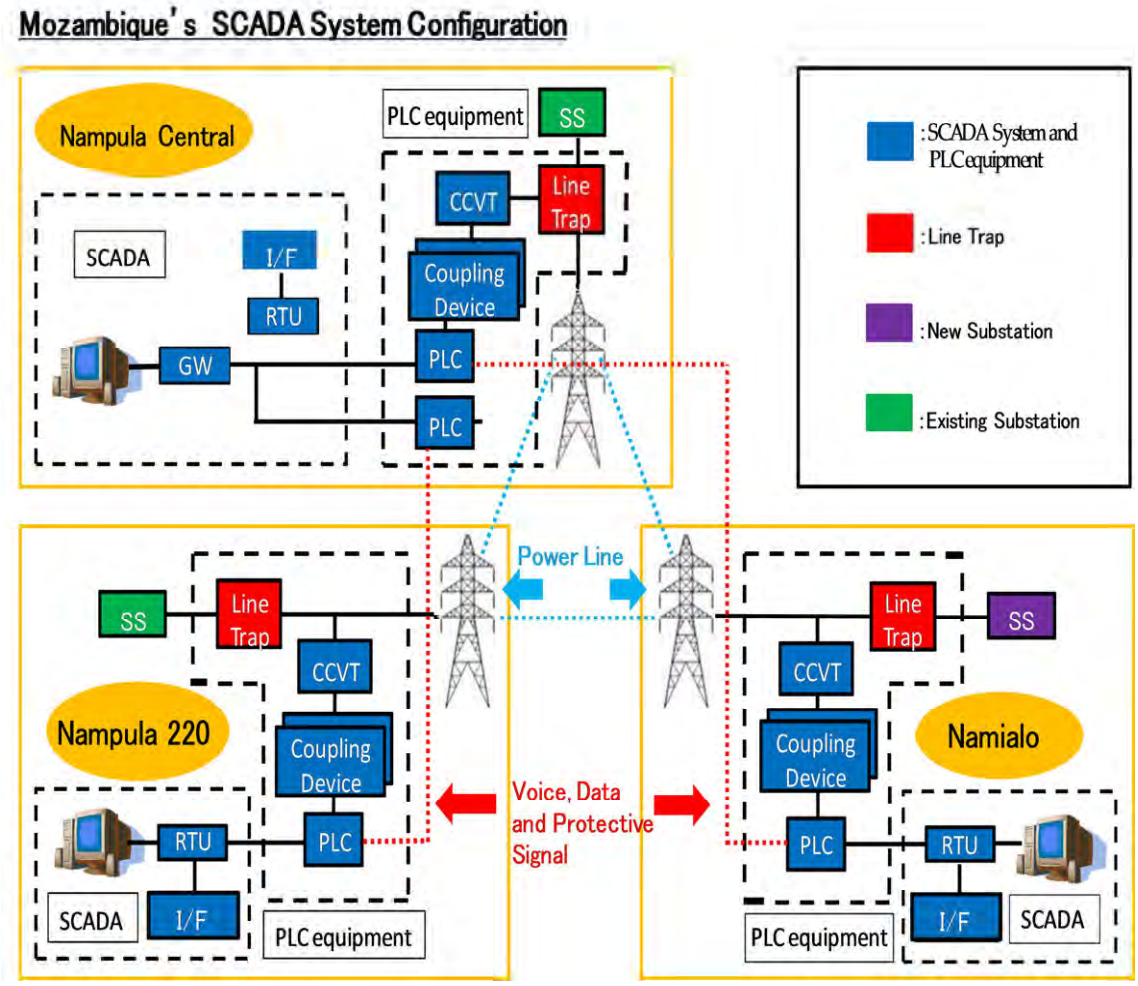


Figure 2-12 SCADA System Configuration

Table 2-1 Basic functions of the SCADA

Item		Function
1) Monitoring function	State monitoring	To display one-line diagrams on a monitor, and to show measurement information such as the on/off state of switches, voltage, current, and active and reactive power. Also, to display the status of equipment required for substation operation such as switch status of relay locks and the tapping display of a transformer.
	Display of alarm and fault information	To display and let operators know equipment failure, power line accident, substation accident, relay operation, and automatic trip of circuit breakers with alarms. Also, to report and display warnings and fault indication of success/failure of reclosing.
	Voltage monitoring Overload monitoring function	To perform automatic monitoring and alarm display when overvoltage, voltage drop, and overload of the transmission lines or transformers occur.
2) Control function	Control and selection	To perform the switch control of remotely controllable equipment such as circuit breakers, disconnecting switches, transformer tapping, and usage/lock of protective relays. Operators can prevent the misidentification and illusion by 2 behavior operations of selection/execution.
	Status display of non-remote control equipment such as grounding devices	For equipment that is manually operated such as grounding for work, the state is displayed on the screen by operators.
3) Recording function	Daily and monthly record	To print and record measurement information such as voltage, active and reactive power of substations from printers as daily and monthly reports. Also, to output the records to a medium in a file form such as Excel data.
	Event records of alarm and fault information	To accumulate alarm and fault information from substations as a database and to print the output from printers as needed. Also, to output the records to a medium in a file form such as Excel data.
	Event records of operation information	To accumulate operation information of substations as a database. The output is printed as needed.

2-2-2-1-5 Distribution Transformers to Non-electrified Communities

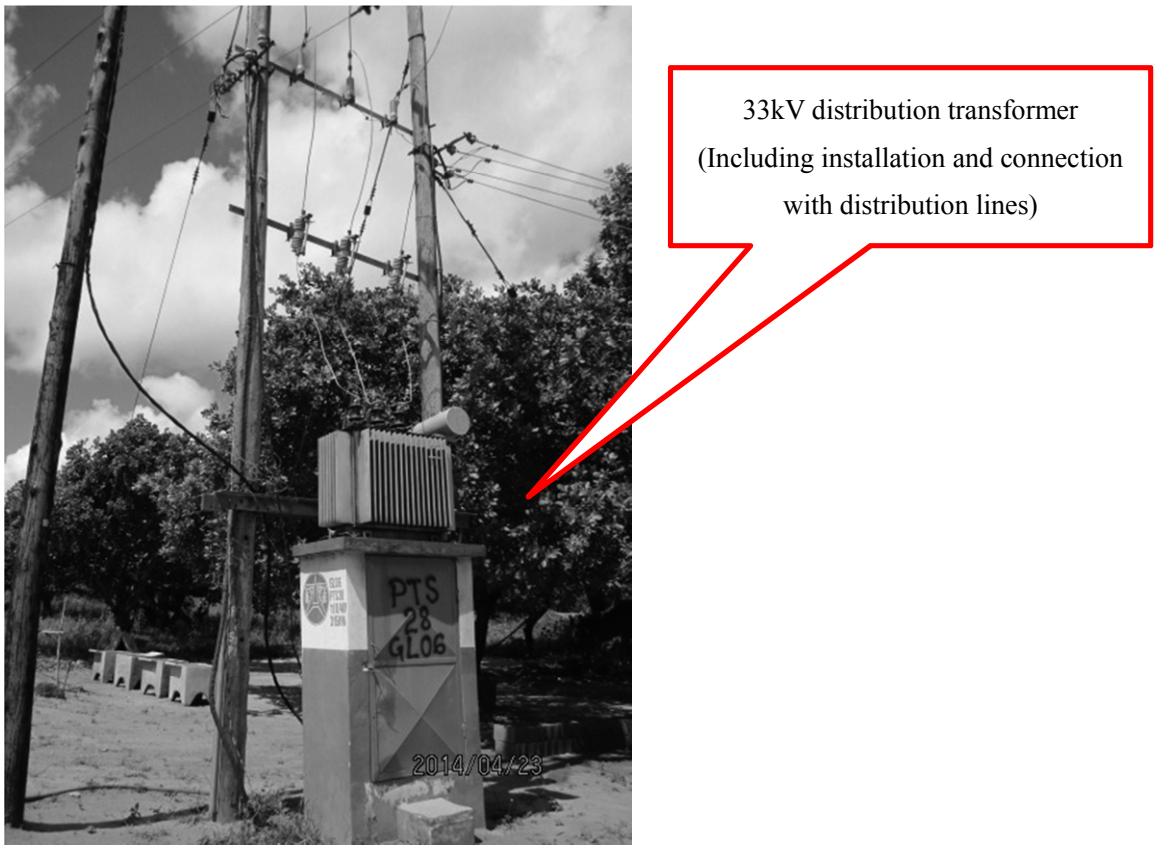


Figure 2-13 Installation image of a 33kV distribution transformer

Distribution transformers will be provided for non-electrified communities within the supply area of the Namialo substation.

The following factors are considered for the selection of non-electrified communities to provide the distribution transformers:

- Strong request from a non-electrified community
- Timing matching with the EDM's electrification plan
- Appeal effect to the areas along the Nacala corridor

As a result of comprehensive evaluation, candidate sites shown in Table 2-2 are selected. Detailed selection background is shown in Appendix-12.

Transformers to be provided are 160kVA × 2 units and 250kVA × 1 unit. It is expected to supply electricity for about 500 households in two villages.

The locations of non-electrified villages to which distribution transformers are provided are shown in Figure 2-14.

In addition to the provision of the transformers, in order to ensure electrical supply to the selected communities, the Japanese side will install distribution transformers, attach them to 33 kV distribution lines, and implement the connection work of a 400 V line to each priority customer for each transformer.

Table 2-2 Overview of the candidate sites where 33kV distribution transformers are provided

Village name	Posto de Secreteriado de 25 de Setembro	Muxaieque
Estimated number of inhabitants	44,000	22,800
Number of households	7,974	3,800
Main buildings	Widely dotted villages Government post office	Scattered villages from roadside to inland
Expected number of households newly receiving electricity	200	300
Unit number and capacity of distribution transformers	160kVA×2 units	250kVA×1 unit
33kV distribution line connection work	New 33kV overhead distribution line: about 50m, 2 circuits	New 33kV overhead distribution line: about 50m, 1 circuit
Connection work of customers and low voltage distribution lines	Government postal office×1 Elementary school×1	Elementary school×1

Figure 2-14 Location of non-electrified communities where distribution transformers will be installed

(1) Installation of Distribution Transformers

An installation example of distribution transformers is shown in Figure 2-15. A distribution transformer is supported by a steel frame that is installed in the middle of the two utility poles. A switchboard box for low-voltage distribution lines is installed at the bottom of the poles. Circuit breakers for low-voltage lines are installed in the box.

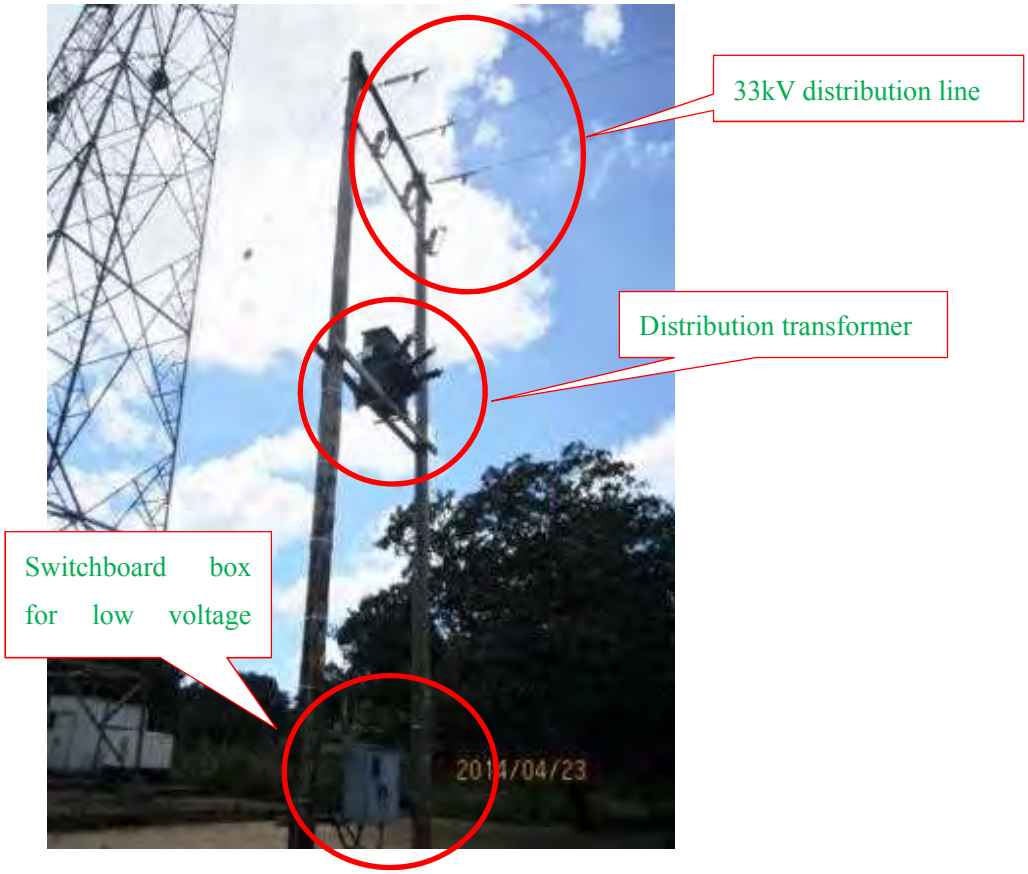


Figure 2-15 Installation example of distribution transformer

(2) 33kV Distribution Line Installation

Non-electrified villages where distribution transformers will be installed are located along the national highway, EN12. Existing 33 kV distribution lines are installed along the EN12 as well. Therefore, the transformers are installed in a location that is recessed about 50 m from the existing 33 kV distribution lines. The connection diagrams of distribution lines are shown in Figure 2-16 and Figure 2-17.

Figure 2-16 Connection diagram of 33kV distribution line of Posto de Secreteriado de 25 de Setembro

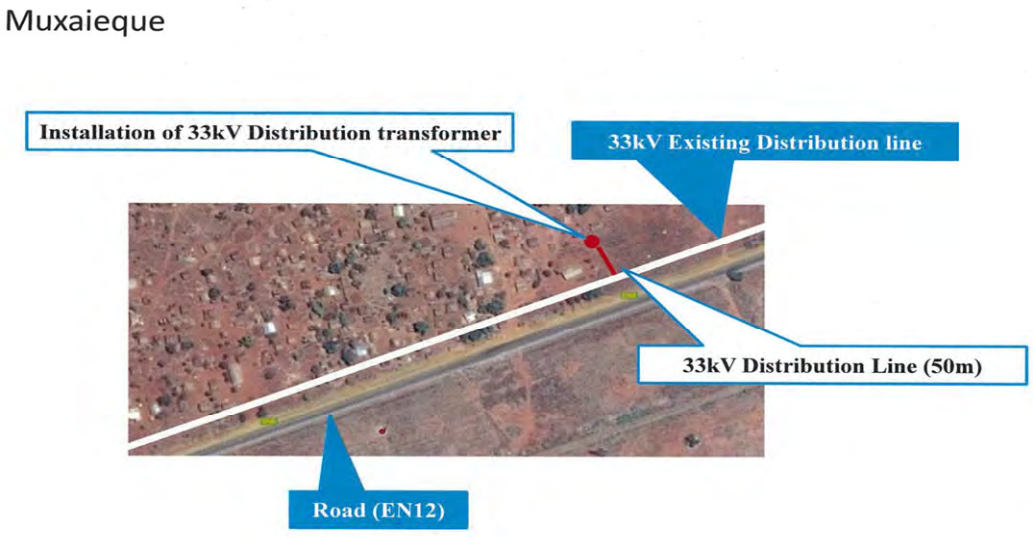


Figure 2-17 Connection diagram of 33kV distribution line of Muxaieque

(3) LV (400V) Distribution Lines

A low-voltage distribution line to each priority customer for each transformer will be provided by the Japanese side, as mentioned below. Lines are supported by wooden poles from the transformer installation point to consumers.

- Posto de Secreteriado de 25 de Setembro
  2 distribution transformers will be installed to Posto de Secreteriado de 25 de Setembro, and two low-voltage lines will be provided by the Japanese side to two priority customers. One is the elementary school and another one is the government post-related office.
- Muxaieque
  1 distribution transformer will be installed in Muxaieque, and one low-voltage line will be provided by the Japanese side to one priority customer, the elementary school.

2-2-2-2 Equipment Plan

Based on the plans mentioned above, the equipment required for this project is planned as shown in Table 2-3 to Table 2-7.

Table 2-3 Overall equipment list of Namialo substation, Transmission tower and SCADA

No.	Item	Qty	Unit	JEC	Note
1	Namialo substation				
1-1-1	Substation equipment				
NMS-01	110/33kVTransformer(40MVA)	1	set	JEC	
NMS-02	110kV Circuit breaker	1	set	JEC	
NMS-03	110kV Disconnector(3 phase type)	4	set	IEC	
NMS-04	110kV Disconnector with Earthing switch(3 phase type)	1	set	IEC	
NMS-05	110kV Current transformer	1	unit	IEC	
NMS-06	110kV Surge arrestor	1	unit	IEC	
NMS-07	33kV Surge arrestor	1	unit	IEC	
NMS-08	33kV Neutral resistance	1	set	IEC	
NMS-09	110kV Surge arrestor	1	unit	IEC	
NMS-10	110kV Voltage transformer	1	unit	IEC	
NMS-11	110kV Current transformer	1	unit	IEC	
NMS-12	110kV Disconnector(3 phase type)	4	set	IEC	

No.	Item	Qty	Unit	JEC	Note
NMS-13	110kV Disconnector with Earthing switch (3 phase type)	1	set	IEC	
NMS-14	110kV Circuit breaker	1	set	JEC	
NMS-15	110kV Surge arrestor	1	unit	IEC	
NMS-16	110kV Voltage transformer	1	unit	IEC	
NMS-17	110kV Current transformer	1	unit	IEC	
NMS-18	110kV Disconnector(3 phase type)	4	set	IEC	
NMS-19	110kV Disconnector with Earthing switch(3 phase type)	1	set	IEC	
NMS-20	110kV Circuit breaker	1	set	JEC	
NMS-21	110kV Surge arrestor	1	unit	IEC	
NMS-22	110kV Voltage transformer	1	unit	IEC	
NMS-23	110kV Current transformer	1	unit	IEC	
NMS-24	110kV Disconnector(3 phase type)	4	set	IEC	
NMS-25	110kV Disconnector with Earthing switch(3 phase type)	1	set	IEC	
NMS-26	110kV Circuit breaker	1	set	JEC	
NMS-27	110kV Surge arrestor	1	unit	IEC	
NMS-28	110kV Voltage transformer	1	unit	IEC	
NMS-29	110kV Current transformer	1	unit	IEC	
NMS-30	110kV Disconnector(3 phase type)	4	set	IEC	
NMS-31	110kV Disconnector with Earthing switch(3 phase type)	1	set	IEC	
NMS-32	110kV Circuit breaker	1	set	JEC	
NMS-33	110kV Circuit breaker	1	set	JEC	
NMS-34	110kV Disconnector with Earthing switch(3 phase type)	2	set	IEC	
NMS-35	110kV Voltage transformer	2	unit	IEC	
1-1-2	110kV Busbar structure				
NMS-37	110kV Busbar conductor	1	lot	IEC	
NMS-38	110kV Line bay conductor	1	lot	IEC	
NMS-39	110kV Bank bay conductor	1	lot	IEC	
NMS-40	110kV Bus-tie conductor	1	lot	IEC	

No.	Item	Qty	Unit	JEC	Note
NMS-41	110kV Bus steel structure	1	lot	IEC	
1-1-3	33kV Equipment				
NMS-42	33kV MV power cable	1	lot	IEC	
NMS-43	33kV Secondary transformer cubicle	1	unit	IEC	
NMS-44	33kV Voltage transformer cubicle	1	unit	IEC	
NMS-45	33kV In-house transformer cubicle	1	unit	IEC	
NMS-46	33kV Feeder cubicle	6	unit	IEC	
1-1-4	110kV Control board equipment				
NMS-47	110kV Transmission bay switchboard(A)	1	unit	IEC	
NMS-48	110kV Transmission bay switchboard(B)	1	unit	IEC	
NMS-49	110kV Transmission bay switchboard(C)	1	unit	IEC	
NMS-50	110kV Transmission bay switchboard(D)	1	unit	IEC	
NMS-51	110kV Bus-tie switchboard(E)	1	unit	IEC	
NMS-52	110kV Transformer bay switchboard(F)	1	unit	IEC	
NMS-61	LV power cable and control cable	1	lot	IEC	
1-1-5	In-house power supply equipment				
NMS-54	In-house power supply switching board	1	unit	IEC	
NMS-55	DC110V Battery charger	2	set	IEC	
NMS-56	DC48V Battery charger	1	set	IEC	
NMS-57	DC110V Battery unit	2	unit	IEC	
NMS-58	DC48V Battery unit	1	unit	IEC	
NMS-59	Emergency Generator	1	set	IEC	
1-1-6	Substation test tool and construction device				
NMS-64	Substation test tool and construction devices	1	lot	IEC	
1-2	Transmission tower				
NMS-60	110kV Overhead transmission tower for double circuit	2	unit	IEC	
NMS-63	110kV Overhead transmission tower (Temporary tower)	1	unit	IEC	

No.	Item	Qty	Unit	JEC	Note
2	SCADA system				
2-1	SCADA system				
SCD-01	SCADA system	3	unit	-	
2-2	PLC Equipment				
NMS-36	110kV Line Trap	8	set	IEC	
NMS-62	PLC Equipment Namialo <--> Nampula Central Nampula Central <--> Nampula 220	4	unit	IEC	
3	Distribution transformer for Non-electrification				
DST-01	Distribution transformer-160kVA	2	set	IEC	
DST-02	Distribution Transformer-250kVA	1	set	IEC	

Table 2-4 Basic Specifications of Namialo substation equipment（No.1）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -01	110/33kVTransformer (40MVA) Namialo substation Down transformer from 110kV to 33kV	Item 1.110/33kVTransformer（40MVA） 1set Specifications 1.Type : Outdoor type, oil immersed with on-load tap changing equipment 2.Rated primary voltage : 110kV 3.Rated secondary voltage : 33kV 4.Rated power capacity : 40MVA 5.Cooling : ONAN/ONAF 6.Number of phase : 3 7.Rated frequency : 50Hz 8.Vector group notation : Y-Y-Δ (YNyn0 d11) 9.Short circuit impedance : 10.0% (Rated capacity base) 10.Number of tap steps : 19 taps 11.JEC specific specifications : Tap changing equipment (1)No. of durable tap changes Mechanical: 800,000 and above Electrical: 200,000 and above (2) IEC specification Mechanical: 200,000 and above Electrical: 20,000 and above
NMS -02	110kV CB Namialo substation Open and close load current and break off fault current in 110kV circuit	Item 1.110kVCB（3 phase type） 1set Specifications 1. Type : Outdoor type, dead tank type, SF6 gas insulation 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-circuit breaking current : 25kA 6.JEC specific specifications : (1)SF6 gas quality requirement 1)Gas purity: 97vol% (99.4wt%) and higher 2)Moisture in gas ・150volppm and lower for arc extinguish medium ・500volppm and lower for insulation medium 3)leakage rate of sealed parts ・0.5%/year and less (2)Gas seal material of CB 1)EP rubber to be used for O ring material 2)Installation of seal washers at bolt junctions to avoid

		carrion of fringe section 3)Apply water-proof grease on fringe surface
NMS -03	110kV Disconnector (3 phase type) Namialo substation Switch bus connection in 110kV circuit and isolate for maintenance and repair	Item 1.110kV Disconnector (3 phase type) 4 sets Specifications 1. Type Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-time withstand current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.2）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -04	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-time withstand current : 25kA
NMS -05	110kV Current transformer Namialo substation Detect load current and fault current in 110kV circuit	Item 1.110kV Current transformer 1 set Specifications 1. Type : Outdoor type, porcelain insulated 2.Rated frequency : 50Hz 3.High system voltage : 123kV 4.Rated primary current : 800A 5.Rated secondary current : 1A 6.Rated short-time thermal current : 25kA
NMS -06	110kV Surge arrestor Namialo substation Discharge abnormal voltage surge to earth in 110kV circuit due to lightning, etc.	Item 1.110kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 123kV 4.Nominal discharge current : 10kA
NMS -07	33kV Surge arrestor	Item 1.33kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 36kV 4.Nominal discharge current : 10kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.3）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -08	33kV Neutral resistance Namialo substation Decrease grounding fault current	Item 1.33kV Neutral resistance 1set Specifications 1. Type : Outdoor, AIS type 2.Rated voltage : 33kV/√3 3.Rated current : 200A 4.Rated duty time : Not less than 10 sec.
NMS -09	110kV Surge arrestor Namialo substation Discharge abnormal voltage surge to earth in 110kV circuit due to lightning, etc.	Item 1.110kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 123kV 4.Nominal discharge current : 10kA
NMS -10	110kVVoltage transformer Namialo substation Detect 110kV circuit voltage	Item 1.110kV Voltage transformer 1 set Specifications 1. Type : Capacitor type 2.Rated frequency : 50Hz 3. High system voltage : 123kV 4.Rated primary voltage : 110/√3kV 5.Rated secondary voltage : 110/√3V
NMS -11	110kV Current transformer Namialo substation Detect load current and fault current in 110kV circuit	Item 1.110kV Current transformer 1 set Specifications 1. Type : Outdoor type, porcelain insulated 2.Rated frequency : 50Hz 3.High system voltage : 123kV 4.Rated primary current : 800A 5.Rated secondary current : 1A 6.Rated short-time thermal current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.4）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -12	110kV Disconnector (3 phase type) Namialo substation Switch bus connection in 110kV circuit and isolate for maintenance and repairing	Item 1.110kV Disconnector (3 phase type) 4 sets Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-time withstand current : 25kA
NMS -13	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-time withstand current : 25kA
NMS -15	110kV Surge arrestor Namialo substation Discharge abnormal voltage surge to earth in 110kV circuit due to lightning, etc.	Item 1.110kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 123kV 4.Nominal discharge current : 10kA
NMS -16	110kV Voltage transformer Namialo substation Detect 110kV circuit voltage	Item 1.110kV Voltage transformer 1 set Specifications 1. Type : Capacitor type 2.Rated frequency : 50Hz 3. High system voltage : 123kV 4.Rated primary voltage : 110/√3kV 5.Rated secondary voltage : 110/√3V

Table 2-4 Basic Specifications of Namialo substation equipment（No.5）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -17	110kV Current transformer Namialo substation Detect load current and fault current in 110kV circuit	Item 1.110kV Current transformer 1 set Specifications 1. Type : Outdoor type, porcelain insulated 2.Rated frequency : 50Hz 3.High system voltage : 123kV 4.Rated primary current : 800A 5.Rated secondary current : 1A 6.Rated short-time thermal current : 25kA
NMS -18	110kV Disconnector (3 phase type) Namialo substation Switch bus connection in 110kV circuit and isolate for maintenance and repair	Item 1.110kV Disconnector (3 phase type) 4 sets Specifications 1. Type Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-time withstand current : 25kA
NMS -19	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short- time withstand current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.6）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -20	110kV CB Namialo substation Open and close load current and break off fault current in 110kV circuit	Item 1.110kVCB（3 phase type） 1set Specifications 1. Type : Outdoor type, dead tank type, SF6 gas insulation 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-circuit breaking current : 25kA 6.JEC specific specification :Same as described in NMS-02
NMS -21	110kV Surge arrestor Namialo substation Discharge abnormal voltage surge to earth in 110kV circuit due to lightning, etc.	Item 1.110kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 123kV 4.Nominal discharge current : 10kA
NMS -22	110kV Voltage transformer Namialo substation Detect 110kV circuit voltage	Item 1.110kV Voltage transformer 1 set Specifications 1. Type : Capacitor type 2.Rated frequency : 50Hz 3. High system voltage : 123kV 4.Rated primary voltage : 110/√3kV 5.Rated secondary voltage : 110/√3V
NMS -23	110kV Current transformer Namialo substation Detect load current and fault current in 110kV circuit	Item 1.110kV Current transformer 1 set Specifications 1. Type : Outdoor type, porcelain insulated 2.Rated frequency : 50Hz 3.High system voltage : 123kV 4.Rated primary current : 800A 5.Rated secondary current : 1A 6.Rated short-time thermal current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（ No.7）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -24	110kV Disconnector (3 phase type) Namialo substation Switch bus connection in 110kV circuit and isolate for maintenance and repairing	Item 1.110kV Disconnector (3 phase type) 4 sets Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short- time withstand current : 25kA
NMS -25	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short- time withstand current : 25kA
NMS -26	110kV CB Namialo substation Open and close load current and break off fault current in 110kV circuit	Item 1.110kVCB（3 phase type） 1set Specifications 1. Type : Outdoor type, dead tank type, SF6 gas insulation 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-circuit breaking current : 25kA 6.JEC specific specification :Same described in NMS-02
NMS -27	110kV Surge arrestor Namialo substation Discharge abnormal voltage surge to earth in 110kV circuit due to lightning, etc.	Item 1.110kV Surge arrestor 1 set Specifications 1. Type : Outdoor type, gapless metal-oxide type 2.Rated frequency : 50Hz 3.Rated voltage : 123kV 4.Nominal discharge current : 10kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.8）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -28	110kV Voltage transformer Namialo substation Detect 110kV circuit voltage	Item 1.110kV Voltage transformer 1 set Specifications 1. Type : Capacitor type 2.Rated frequency : 50Hz 3. High system voltage : 123kV 4.Rated primary voltage : 110/√3kV 5.Rated secondary voltage : 110/√3V
NMS -29	110kV Current transformer Namialo substation Detect load current and fault current in 110kV circuit	Item 1.110kV Current transformer 1 set Specifications 1. Type : Outdoor type, porcelain insulated 2.Rated frequency : 50Hz 3.High system voltage : 123kV 4.Rated primary current : 800A 5.Rated secondary current : 1A 6.Rated short-time thermal current : 25kA
NMS -30	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short- time withstand current : 25kA
NMS -31	110kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short- time withstand current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.9）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -32	110kV CB Namialo substation Open and close load current and break off fault current in 110kV circuit	Item 1.110kVCB（3 phase type） 1set Specifications 1. Type : Outdoor type, dead tank type, SF6 gas insulation 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 500A 5.Rated short-circuit breaking current : 25kA 6.JEC specific specification :Same described in NMS-02
NMS -33	110kV CB Namialo substation Open and close load current and break off fault current in 110kV circuit	Item 1.110kVCB（3 phase type） 1set Specifications 1. Type : Outdoor type, dead tank type, SF6 gas insulation 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 2500A 5.Rated short-circuit breaking current : 25kA 6.JEC specific specification :Same described in NMS-02 7.Bushing CT : Primary current 4000A, Secondary current 1A
NMS -34	10kV Disconnector with Earthing switch (3 phase type) Namialo substation Use for both line disconnection and earthing	Item 1.110kV Disconnector with Earthing switch(3 phase type) 1 set Specifications 1. Type : Outdoor type, single-throw, motor-operated 2.Rated frequency : 50Hz 3.Rated voltage : 110kV 4.Rated normal current : 2500A 5.Rated short- time withstand current : 25kA

Table 2-4 Basic Specifications of Namialo substation equipment（No.10）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -35	110kV Voltage transformer Namialo substation Detect 110kV circuit voltage	Item 1.110kV Voltage transformer 1 set Specifications 1. Type : Capacitor type 2.Rated frequency : 50Hz 3. High system voltage : 123kV 4.Rated primary voltage : 110/√3kV 5.Rated secondary voltage : 110/√3V
NMS -37	110kV Busbar conductor Namialo substation Carry bus current through busbar conductor in 110kV circuit	Item 1.110kV Busbar conductor 1 lot 2.110kVBusbar support insulator 1 lot Specifications 1. Type : TACSR(Thermal-resistant aluminum alloy conductor steel reinforced) 2.Rated frequency : 50Hz 3.Cross sectional area : 1160mm² 4. High system voltage : 123kV 5.Maximum current capacity : 2500A 6.Rated short-circuit withstand current : 25kA 7.Conductor length : 1000m
NMS -38	110kV Line bay conductor Namialo substation Carry line power to 110kV bus line	Item 1.110kV Line bay conductor 1 lot 2.110kV Line bay support insulator 1 lot Specifications 1. Type : TACSR(Thermal-resistant aluminum alloy conductor steel reinforced) 2.Rated frequency : 50Hz 3.Cross sectional area : 200mm² 4. High system voltage : 123kV 5.Maximum current capacity : 800A 6.Rated short-time withstand current : 25kA 7.Conductor length : 1000m

Table 2-4 Basic Specifications of Namialo substation equipment（ No.11）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -39	110kVBank bay conductor Namialo substation Carry bank power from 110kV bus line to transformer	Item 1.110kV Bank bay conductor 1 lot 2.110kV Bank bay support insulator 1 lot Specifications 1. Type : TACSR(Thermal-resistant aluminum alloy conductor steel reinforced) 2.Rated frequency : 50Hz 3.Cross sectional area : 120mm^2 4. High system voltage : 123kV 5.Maximum current capacity : 500A 6.Rated short-circuit withstand current : 25kA 7.Conductor length : 250m
NMS -40	110kVbus-tie conductor Namialo substation Interchange bus current between double 110kV busbar	Item 1.110kV Bus-tie conductor 1 lot 2.110kV Bus-tie support insulator 1 lot Specifications 1. Type : TACSR(Thermal-resistant aluminum alloy conductor steel reinforced) 2.Rated frequency : 50Hz 3.Cross sectional area : 1160mm^2 4. High system voltage : 123kV 5.Maximum current capacity : 2500A 6.Rated short-time withstand current : 25kA 7.Conductor length : 200m
NMS -41	110kVBus steel structure Namialo substation Support 110kV conductor and insulator	Item 1.110kVBus steel structure 1 lot Specifications 1. Type : Out-door installation 2.Steel material : Hot-dip galvanized steel structure

Table 2-4 Basic Specifications of Namialo substation equipment（ No.12）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -42	33kV MV power cable Namialo substation Secondary transformer power cable from 110kV/33kV Tr. to 33kV cubicle	Item 1.33kV XLPE cable 1 lot XLPE: Cross-linked polyethylene insulated vinyl sheath cable Specifications 1. Type : Single core XLPE cable with aluminum wire armored and vinyl sheath 2.Conductor : Copper 3. High system voltage : 36kV 4.Cable length : 170m/phase × 3 phase 5.Cable terminal : 6 sets 6.Cable head : 1 set 7.Cable head support structure : 1set
NMS -43	33kV Secondary transformer cubicle Namialo substation Connected from secondary transformer through cable and installed 33kV CB and disconnector	Item 1.33kV Secondary transformer cubicle 1 unit Specifications 1. Type : Indoor cubicle type 2.Rated voltage : 33kV 3. High system voltage : 36kV 4.Rated frequency : 50Hz 5.Rated short- time withstand current : Not less than 25kA 6.Insulation type : AIS or SF_6 gas insulation type 7.Current transformer : Primary current 2000A, Secondary current 1A 8.CB : Vacuum type or SF_6 gas type CB : O-0.3S-CO-15s-CO 9. Disconnector : Disconnector with Earthing switch 10.Protective relay : OCGR(Phase-to-ground overcurrent relay),OCR(Over current relay) : OVGR(Ground protection relay),CB failure relay

Table 2-4 Basic Specifications of Namialo substation equipment（ No.13）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -44	33kV VT cubicle Namialo substation Detect voltage in 33kVbusbar	Item 1.33kV VT(Voltage Transformer) cubicle 1 unit Specifications 1. Type : Indoor cubicle type 2.Rated voltage : 33kV 3. High system voltage : 36kV 4.Rated frequency : 50Hz 5.Rated short- time withstand current : Not less than 25kA 6.Insulation type : AIS or SF_6 gas insulation type 7.VT : Primary voltage 33/√3kV : Secondary voltage 110/√3V 8. Disconnector : Disconnector with Earthing switch 9.Protective relay : Synchronous detector, UV(Under voltage),OV(Overvoltage), Over-frequency, Under-frequency relays

Table 2-4 Basic Specifications of Namialo substation equipment（ No.14）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -45	33kVIn-house transformer cubicle Namialo substation Supply power to all of substation machinery and devices	Item 1.33kVIn-house transformer cubicle 1 unit Specifications 1. Type : Indoor cubicle type 2.Rated voltage : 33kV 3. High system voltage : 36kV 4.Rated frequency : 50Hz 5.Rated short- time withstand current : Not less than 25kA 6.Insulation type : AIS or SF_6 gas insulation type 7.CT : Primary current 2000A, Secondary current 1A 8.CB : Vacuum type or SF_6 gas type CB : O-0.3S-CO-15s-CO 9. Disconnector : Disconnector with Earthing switch 10.Protective relay : OCGR(Phase-to-ground overcurrent relay),OCR(Over current relay) : CB failure relay 11.Transformer : Rated secondary voltage 380V : Short circuit impedance 4% : Vector group notation Dyn11 : Number of tap steps 5 （Off-load changer） : Mold insulation type

Table 2-4 Basic Specifications of Namialo substation equipment（ No.15）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -46	33kV Feeder cubicle Namialo substation Supply electric power to distribution lines	Item 1.33kV Feeder cubicle 6 units Specifications 1. Type : Indoor cubicle type 2.Rated voltage : 33kV 3. High system voltage : 36kV 4.Rated frequency : 50Hz 5.Rated short- time withstand current : Not less than 25kA 6.Insulation type : AIS or SF_6 gas insulation type 7.CT : Primary current 2000A, Secondary current 1A 8.CB : Vacuum type or SF_6 gas type CB : O-0.3S-CO-15s-CO 9. Disconnector : Disconnector with Earthing switch 10.Protective relay : OCGR(Phase-to-ground overcurrent relay),OCR(Over current relay) : Reclose relay, CB failure relay 11.Arrestor : Indoor type, gapless metal-oxide type : Rated voltage 36kV : Nominal discharge current 10kA 12.Monitor item : Current, Voltage, Active power, Reactive power : Transmitted kWh

Table 2-4 Basic Specifications of Namialo substation equipment（ No.16）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -47	110kV Transmission bay switchboard(A) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Transmission bay switchboard(A) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Current, Voltage, Active power, Reactive power : Received or Transmitted kWh 3.Prtective relay : Distance relay, OCGR(Phase-to-ground overcurrent relay) : Directional grounding relay, OCR(Over current relay) : Reclose relay, Fault locator relay : CB failure relay 4.Note : Protective relay shall be duplicated sets.
NMS -48	110kV Transmission bay switchboard(B) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Transmission bay switchboard(B) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Current, Voltage, Active power, Reactive power : Received or Transmitted kWh 3.Prtective relay : Distance relay, OCGR(Phase-to-ground overcurrent relay) : Directional grounding relay, OCR(Over current relay) : Reclose relay, Fault locator relay : CB failure relay 4.Note : Protective relay shall be duplicated sets.

Table 2-4 Basic Specifications of Namialo substation equipment（ No.17）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -49	110kV Transmission bay switchboard(C) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Transmission bay switchboard(C) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Current, Voltage, Active power, Reactive power : Received or Transmitted kWh 3.Protective relay : Distance relay, OCGR(Phase-to-ground overcurrent relay) : Directional grounding relay, OCR(Over current relay) : Reclose relay, Fault locator relay : CB failure relay 4.Note : Protective relay shall be duplicated sets.

Table 2-4 Basic Specifications of Namialo substation equipment（ No.18）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -50	110kV Transmission bay switchboard(D) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Transmission bay switchboard(D) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Current, Voltage, Active power, Reactive power : Received or Transmitted kWh 3.Prtective relay : Distance relay, OCGR(Phase-to-ground overcurrent relay) : Directional grounding relay, OCR(Over current relay) : Reclose relay, Fault locator relay : CB failure relay 4.Note : Protective relay shall be duplicated sets.
NMS -51	110kV Bus-tie switchboard(E) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Bus-tie bay switchboard(E) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Frequency, voltage, current 3.Prtective relay : Distance relay, OCGR(Phase-to-ground overcurrent relay) : CB failure relay, Fault locator relay : UV(Under voltage),OV(Overvoltage) relays : Zero-phase differential relay 4.Note : Protective relay shall be duplicated sets.
NMS -52	110kV Transformer bay switchboard(F) Namialo substation Monitor, protection and control for 110kV substation facilities	Item 1.110kV Transformer switchboard(E) 1 unit Specifications 1. Type : Indoor self-support board type 2. Monitor item : Primary winding : Current, Active power, Reactive power : Secondary winding : Current, Active power, Reactive power 3.Prtective relay : OCGR(Phase-to-ground overcurrent relay),OCR(Over current relay) : Differential current relay, CB failure relay

Table 2-4 Basic Specifications of Namialo substation equipment（ No.19）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -61	LV power cable and control cable Namialo substation LC power cable for substation devices and control cable for monitor and protection	Item 1. LV power cable and control cable 1 lot Specifications 1.LV cable : Power cable and control cable 2.Earthing material : Copper earthing conductor, earthing lots and earthing connectors 3.Cable connector : Cable tube, cable trench and cable hook : Connector terminal
NMS -54	In-house power supply switching board Namialo substation Supply power to electric machinery in substation	Item 1. In-house power supply switching board 1 unit Specifications 1. Type : Indoor self-support board type 2.Supply voltage : 3-phase 380 V, Single phase 200 V 3.Rated short-circuit breaking current of main CB : Not less than 1250A 4.Estimated load : Monitor, control and protection for substation facilities : Battery charger, room lighting and outdoor lights : Air-conditioning and other devices
NMS -55	DC110V battery charger Namialo substation Supply DC power to control and protection devices and charge 110V battery	Item 1.DC110V battery charger 2 units Specifications 1. Type : Indoor self-support board type 2.Input voltage : 3 phase 380V or Single phase 200V 3.Output voltage : Direct current 110V±5% 4.Maximum current output : ±2% of rated current

Table 2-4 Basic Specifications of Namialo substation equipment（ No.20）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -56	DC48V battery charger Namialo substation Supply DC power to telecommunication devices and charge 48V battery	Item 1.DC48V battery charger 1 units Specifications 1. Type : Indoor self-support board type 2.Input voltage : 3 phase 380V or Single phase 200V 3.Output voltage : Direct current 48V±5% 4.Maximum current output : ±2% of rated current
NMS -57	DC110V battery unit Namialo substation Supply DC power to control and protection devices in emergency	Item 1.DC110V battery unit 2 units Specifications 1. Type : lead-acid battery 2.Installation : Rack installation type 3.DC load : Control devices of substation : Emergency light 4.Available supply duration : 10hours
NMS -58	DC48V battery unit Namialo substation Supply DC power to telecommunication devices in emergencies	Item 1.DC48V battery unit 1 unit Specifications 1. Type : lead-acid battery 2.Installation : Rack installation type 3. DC load : Telecommunication devices 4.Available supply duration : 10hours
NMS -59	EG(Emergency Generator) Namialo substation Emergency power source in case of system outage	Item 1. EG(Emergency Generator) 1 unit Specifications 1. Type : Outdoor, cubicle type 2.Power capacity : Not less than 50kVA 3.Generatoion type : Diesel engine driven generation 4.Rated frequency : 50Hz 5..Rated voltage : 3 phase 380V 6.Maximum continuous operation duration : 10hours

Table 2-4 Basic Specifications of Namialo substation equipment（No.21）

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -64	Substation test tool and construction devices Namialo substation Tools and devices for substation construction work	Item 1. Test tool and construction devices 1 lot Specifications 1.CB test tool 2.Relay test tool 3 Operation handle 4.Others（Tester, Voltage checker, Earth resistance meter,, Ohm-meter, etc. ）

Table 2-5 Basic Specifications of Transmission Tower for connection to Namialo substation

NMS -60	110kV Overhead transmission tower for double circuit Adjoining Namialo substation Tower for substation drawing	Item 1.Tower 2 unit Specifications 1. Type : Tension tower type (Dead-end type) 2.Minimum Clearance to ground : 6,500mm 3.Maximum wind velocity for tower design : 35m/sec 4.Tower foundation : Concrete pad and chimney foundation 5.Tower height : 30m
NMS -63	10kV Overhead transmission tower for double circuit (Temporary tower) Adjoining Namialo substation Temporarily relocate lines for substation construction	Item 1.Tower 1 unit Specifications 1. Type : Tension tower type (Dead-end type) 2.Minimum Clearance to ground : 6,500mm 3.Maximum wind velocity for tower design : 35m/sec 4.Tower foundation : Concrete pad and chimney foundation 5.Tower height : 30m

Table 2-6 Basic Specifications of SCADA system (No.1)

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
SCD -01	SCADA system Nampula Central, Nampula 220 and Namialo substation Supervisory control of substation facilities	Item 1.SCADA system 3 units 1) Nampula Central substation Host SCADA 2) Nampula 220 substation Local SCADA 3) Namialo substation Local SCADA Specifications 1. Type : Indoor installation type 2.Site : 1) Nampula Central substation 2) Nampula 220 substation 3) Namialo substation 3.Monitor function : Status monitoring, alarm and event monitoring : Automated monitoring on voltage and overload 4.Control function : Selection and operation, setting the status of manually operated devices 5.Recording and report function : Daily and monthly report : Alarm and event logging : Operation logging 6.Data setting manipulation function : Data setting for automated voltage and overload monitoring : Data preparation function 7.Hardware specification : PC or EWS 1 unit, LCD 2 units : Printer 1 unit, UPS : RTU 3 units

Table 2-6 Basic Specifications of SCADA system (No.2)

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
NMS -36	110kV Line trap for tele-communication Nampula Central – Nampula 220 Nampula Central – Namialo lines Use transmission line as tele-communication channel	Item 1. 110kV Line trap 8 units (2 phase/line × 2 terminals × 2lines) Specifications 1. Type : Outdoor suspended line attachment 2.Rated voltage : 110kV 3. High system voltage : 123kV 4.Rated frequency : 50Hz 5.Nominal current : 800A 6. Inductance : 0.315 mH 7.Blocking Impedance : 600Ω and above 8.Tuning Device blocking bandwidth : 40kHz to 500kHz 9. Attachment : Suspend metal fitting, Gap device for surge suppression and other necessary attachment
NMS -62	110kV PLC(Power Line Carrier) Nampula Central – Nampula 220 Nampula Central – Namialo lines Use transmission line as tele-communication channel	Item 1.110kV PLC system 4 lots 1) Nampula Central - Nampula 220 2 lots 2) Nampula Central – Namialo 2 lots Specifications 1. Type : Indoor self-supporting board type 2.Power transmission : 50W 3.Line voltage : 110kV transmission line 4.Channel : Data channel 1 unit : Voice channel 1 unit (2wires/hotline) 5.Data speed : Higher than 1,200 bps for asynchronous data transfer 6.Transmission line length : Nampula Central - Nampula 220 4km : Nampula Central – Namialo 80km

Table 2-7 Basic Specifications of the Distribution transformer

No. of list	Equipment name/Installation location /Usage objective	Main specification and item
DST -01 -02	33kV/400V LV Distribution transformer Communities to be electrified around the Namialo district Supply electricity to domestic household	Item 1.33kV/400V LV Distribution transformer 160kVA 2 units 2. ditto 250kVA 1 unit Specifications 1. Type : Outdoor steel frame mounted type 2.Rated voltage : 33kV 3. High system voltage : 36kV 4.Rated frequency : 50Hz 5.Rated short-circuit withstand current : Not less than 25kA 6. Transformer : Capacity 160kVA and 250kVA : Rated secondary voltage 380V : Short circuit impedance 6% : Vector group notation Dyn11 : Number of tap steps 5 (Off-load changer) : Oil immersed insulation type

2-2-2-3 Plan for Building Facilities and Exterior Work

1) Control Building

a) Plan

In consideration of the operation of the new Namialo substation (110 kV/33 kV) and a connection with the planned substation (400 kV/220 kV & 400 kV/110 kV) which will be adjacently constructed as a part of Chimuara – Nacala Transmission Project, the following rooms are designed as per the requirement from the EDM's standard.

- 110 kV Protection and Control Room
- Supervision and Control Room (for future connections)
- 33 kV Cubicle Room
- PLC & RTU Room
- Low-voltage Distribution Panel Room
- Battery Room
- Spare Parts Store Room
- Office, Kitchen, and Toilet

Total floor area is 612.50 m^2.

b) Section

Since there is no spatial limitation to the site, a single story is adopted. Room height and size of doors are designed in consideration of the maintenance and size of each piece of equipment, which will be accommodated in the building.

c) Structure

The structure of the building will be designed according to the design conditions and code described in the section 2-2-1.(2) & (4), and RC (reinforced concrete) structure is adopted as mentioned in the section 2-2-1.(6).2).

d) Mechanical & Electrical facilities

In consideration of the requirement from the equipment and also the environment for operational staffs, the following rooms will be equipped with air conditioner.

- 110kV Protection and Control Room
- Supervise and Control Room (for future connections)
- 33kV Cubicle Room
- PLC & RTU Room

- Low Voltage Distribution Panel Room
- Office

Since there is no public line for water supply and sewer, a water reservoir tank is designed so the EDM can purchase the water from outside, and a septic tank and soak pit are designed for sewage. It is the same as the existing Monapo substation.

e) Finishing

The finishing of major rooms is designed according to the Table 2-8 below in consideration of the usage and purpose of the rooms as well as availability of materials.

Table 2-8 Major rooms Design

Room	Floor	Wall	Ceiling
Equipment Room with Air conditioner	Dust-proof paint	Acrylic emaulsion Paint (AEP)	Acoustic board suspended ceiling
Equipment Room without Air conditioner	Dust-proof paint	AEP	AEP
Battery Room	Acid-resistant paint	Acid-resistant paint	AEP
Office	PVC sheet	AEP	Acoustic board suspended ceiling
Toilet	Ceramic tile	Ceramic tile	Cementitious board suspended ceiling

2) Guard House

Outline of this building is as follows:

- Floor area: 24m2
- Structure: RC (reinforced concrete) single story
- Air conditioning: No air conditioner
- Finishing:
  Floor: Dust-proof paint, Wall and ceiling: AEP

3) Exterior Work

The exterior work for the new Namialo substation is designed as below:

- Equipment installation area: Gravel laying to avoid the incident due to electric shock

- Approach to Control Building from the Entrance: Concrete pavement
- Road in the premises: Gravel pavement

Since there is no city line for rainwater drainage, rainwater is drained out of the premises by slope and penetrate into the ground.

The outdoor lighting facilities are designed according to the EDM standard for the design of each substation.

2-2-3 Outline Design Drawing

Outline Design Drawings are listed in the Table 2-9 below.

Table 2-9 Outline Design Drawings

Dwg No.	Contents of the Drawing
N-01	Landscape of the project site
N-02	Namialo substation layout plan
N-03	Single diagram plan for the Namialo substation
N-04	Equipments layout plan for the Namialo substation
N-05	Equipment cross section layout plan for the Namialo substation
N-06	Control building layout plan for the Namialo substation
N-07	Control building pit layout plan for the Namialo substation
N-08	Control building cross section layout plan for the Namialo substation
N-09	Transmission lines route plan around the Namialo substation
A-01~A-09	Control building & Guard house architectural drawings
S-01~05	Control building & Guard house structural drawings
M-01~04	Control building & Guard house mechanical drawings
E-01~12	Control building & Guard house electrical drawings

8,349,300 S | 8,349,200 S | 8,349,100 S | 8,349,000 S | 8,348,900 S | 8,348,800 S | 8,348,700 S | 8,348,600 S | 8,348,500 S | 8,348,400 S | 8,348,300 S | 8,348,200 S | 8,348,100 S | 8,348,000 S | 8,347,900 S | 8,347,800 S | 8,347,700 S | 8,347,600 S | 8,347,500 S | 8,347,400 S

603,800 E
603,700 E
603,600 E
603,500 E
603,400 E
603,300 E
603,200 E
603,100 E
603,000 E

ROAD (EN12)
RAILWAY
EXISTING 110kV TRANSMISSION LINE
TO METORO
TO NACALA
PROPOSED ACCESS ROAD
NEW NAMIALO SUBSTATION
TO NAMPULA 220
TO NAMPULA CENTRAL

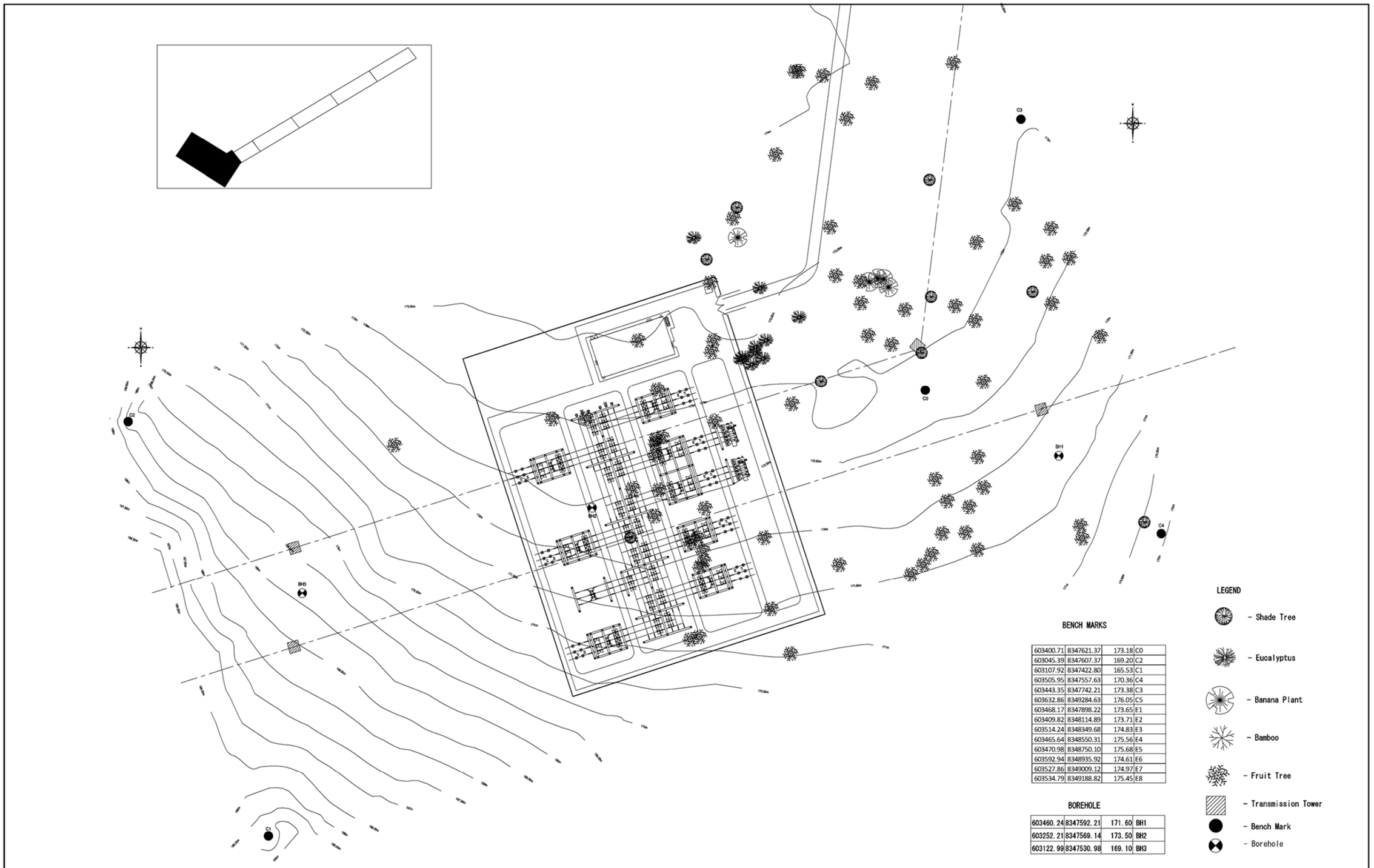
0 50 100 150 200 250 300 m

Projection UTM - Zone 37 S
Ellipsoid : WGS 84

LEGEND

- Shade Tree
- Eucalyptus
- Banana Plant
- Bamboo
- Fruit Tree
- Transmission Tower
- Bench Mark
- Borehole

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: A1 : 1/2500 A3 : 1/5000	DWG. TITLE: LANDSCAPE OF THE PROJECT SITE
		DATE: Jan. 2015	DWG. NO.: N-01
		DRAWN BY	Oriental Consultants Global Co.,Ltd. / Tokyo Electric Power Services Co.,Ltd.
		CHECKED BY	
		REVISIONS: NO. DATE DESCRIPTIONS BY APPD	



BENCH MARKS

603400.71	8347621.37	173.18	C0
603045.39	8347607.37	169.20	C2
603107.92	8347422.80	165.53	C1
603505.95	8347557.63	170.36	C4
603443.35	8347742.21	173.38	C3
603632.86	8349284.63	176.05	C5
603468.17	8347898.22	173.65	E1
603409.82	8348114.89	173.71	E2
603514.24	8348349.68	174.83	E3
603465.64	8348550.31	175.56	E4
603470.98	8348750.10	175.68	E5
603592.94	8348935.92	174.61	E6
603527.86	8349009.12	174.97	E7
603534.79	8349188.82	175.45	E8

BOREHOLE

603460.24	8347592.21	171.60	BH1
603252.21	8347569.14	173.50	BH2
603122.99	8347530.98	169.10	BH3

LEGEND

- Shade Tree
- Eucalyptus
- Banana Plant
- Bamboo
- Fruit Tree
- Transmission Tower
- Bench Mark
- Borehole

0 10 20 30 40m

PROJECT TITLE

PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

NO.	DATE	DESCRIPTIONS	BY	APPD

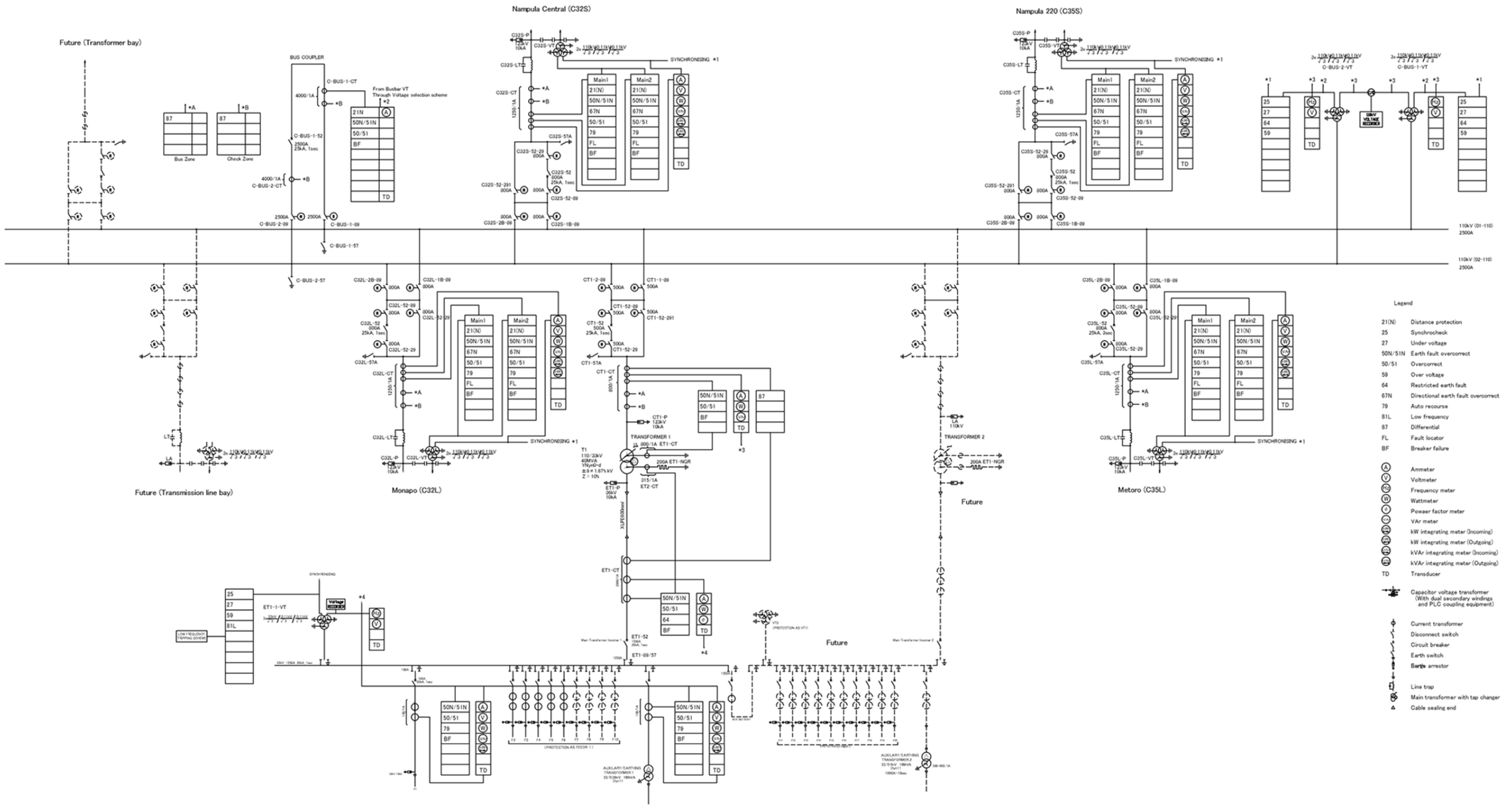
REVISIONS

SCALE: None
DATE: Dec. 2014
DRAWN BY
CHECKED BY

DWG. TITLE: Namialo substation layout plan

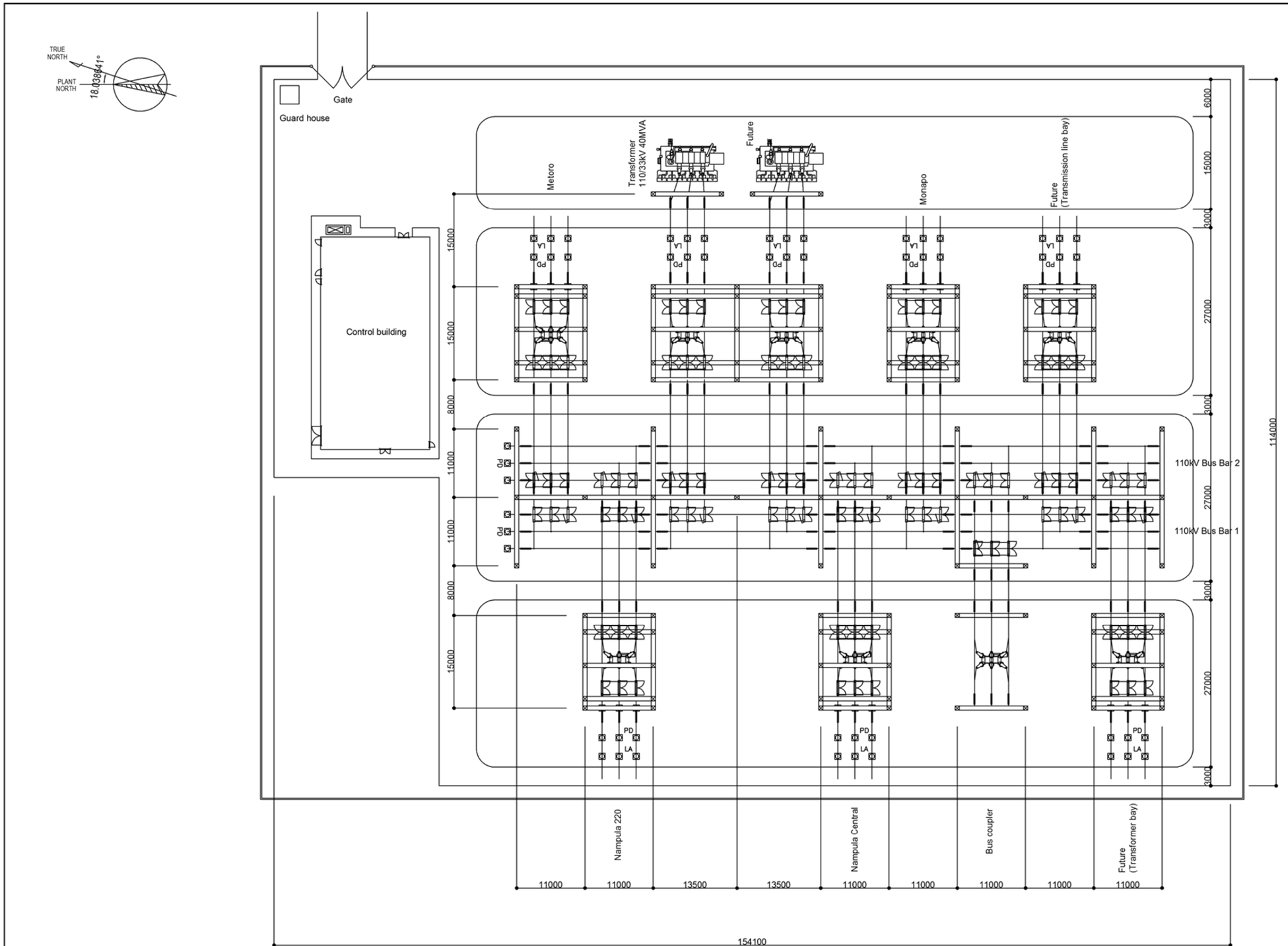
N-02

Oriental Consultants Global Co.,Ltd.
Tokyo Electric Power Services Co.,Ltd.

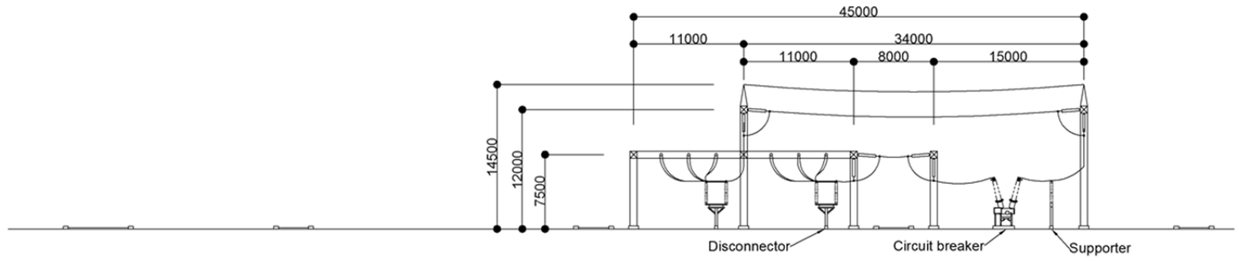


PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: None	DWG. TITLE: Single diagram plan for the Namialo substation	DWG. NO.: N-03
		DATE: Dec. 2014		
		DRAWN BY	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.
		CHECKED BY		

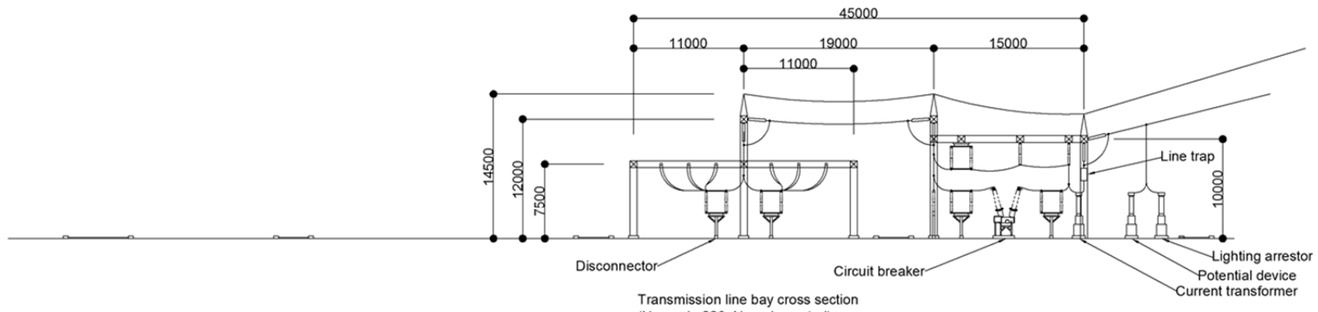
NO. | DATE | DESCRIPTIONS | BY | APPD — REVISIONS



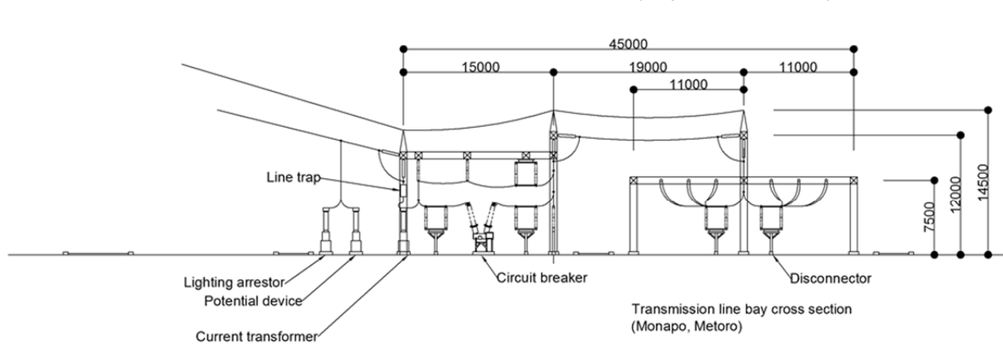
PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: A1 : 1/300, A3 : 1/600	DWG. TITLE: EQUIPMENTS LAYOUT PLAN FOR THE NAMIALO SUBSTATION	DWG. NO.: N-04
		DATE: Jan. 2015		
		DRAWN BY	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.
		CHECKED BY		
		NO. / DATE / DESCRIPTIONS / BY / APPD. REVISIONS		



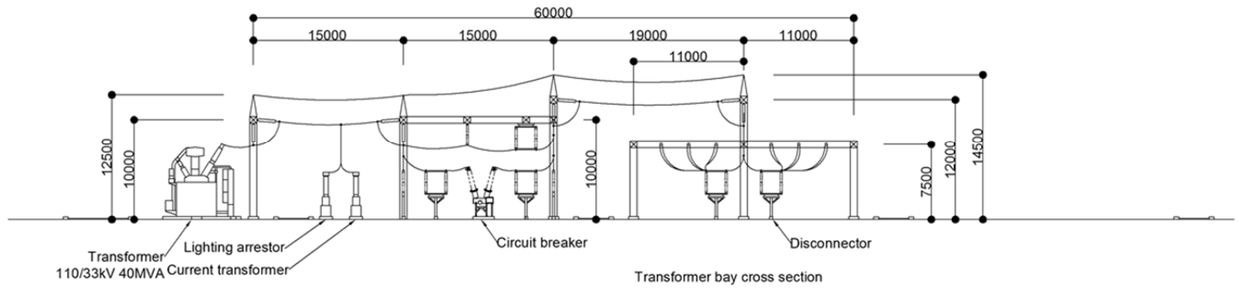
Bus coupler cross section



Transmission line bay cross section
(Nampula 220, Namula central)

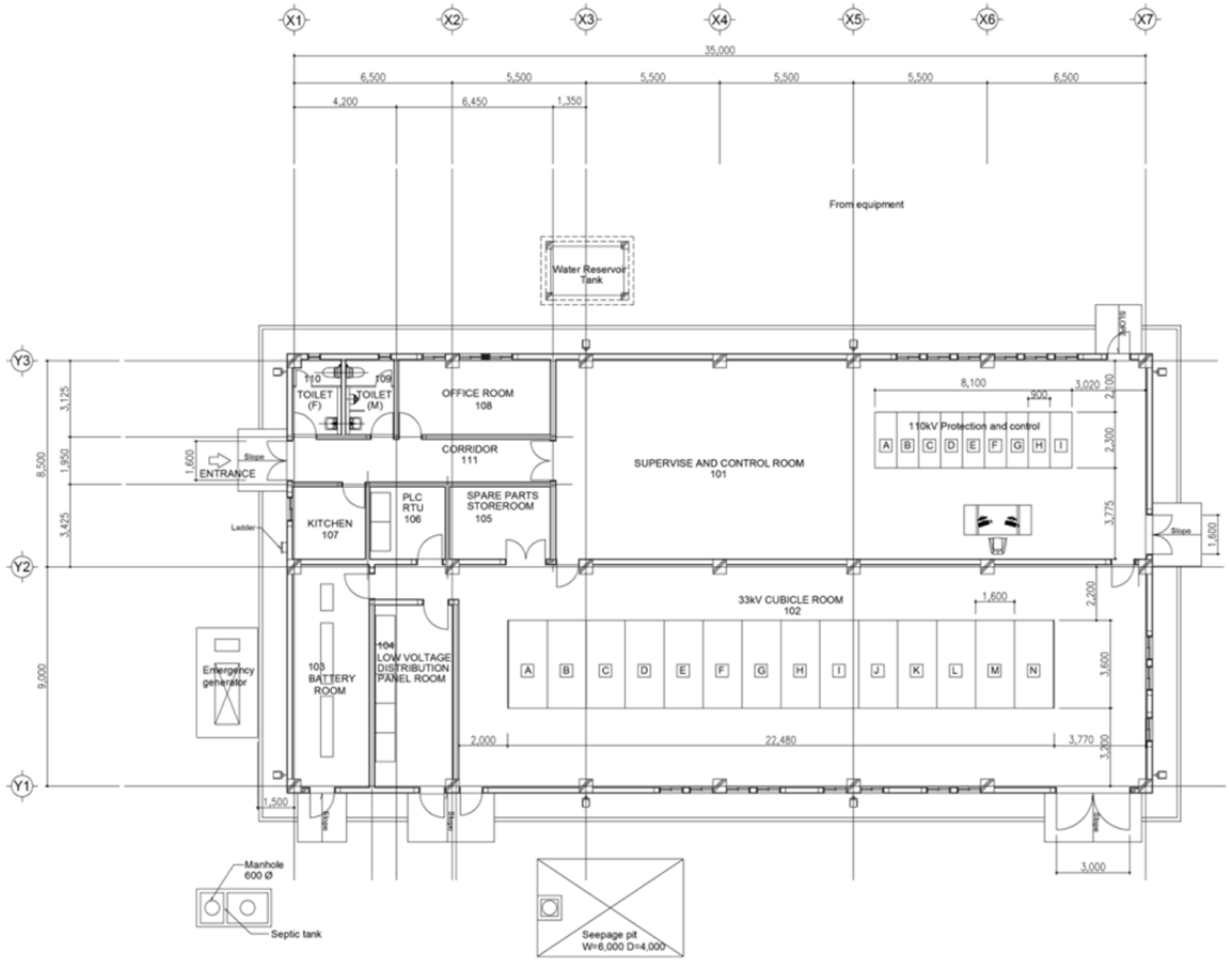


Transmission line bay cross section
(Monapo, Metoro)



Transformer bay cross section

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: None	DWG. TITLE: Equipments cross section layout plan for The Namialo substation	DWG. NO.: N-05
		DATE: Dec. 2014		
	NO. DATE DESCRIPTIONS BY APPD REVISIONS	DRAWN BY	Oriental Consultants Global Co.,Ltd.	TEPSCO Tokyo Electric Power Services Co.,Ltd.
		CHECKED BY		



PROJECT TITLE

PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

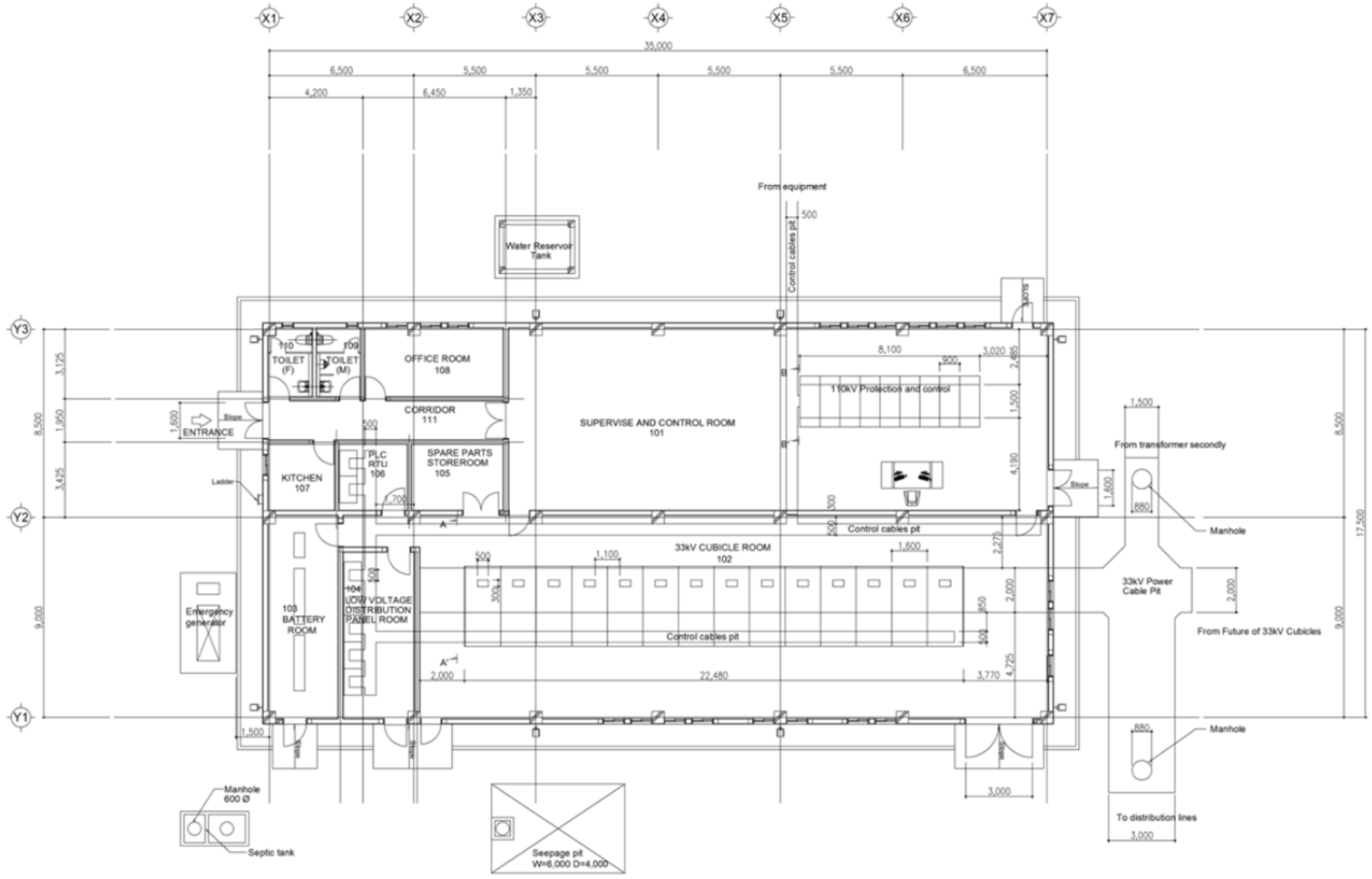
GENERAL NOTE

SCALE: None
DATE: Dec. 2014

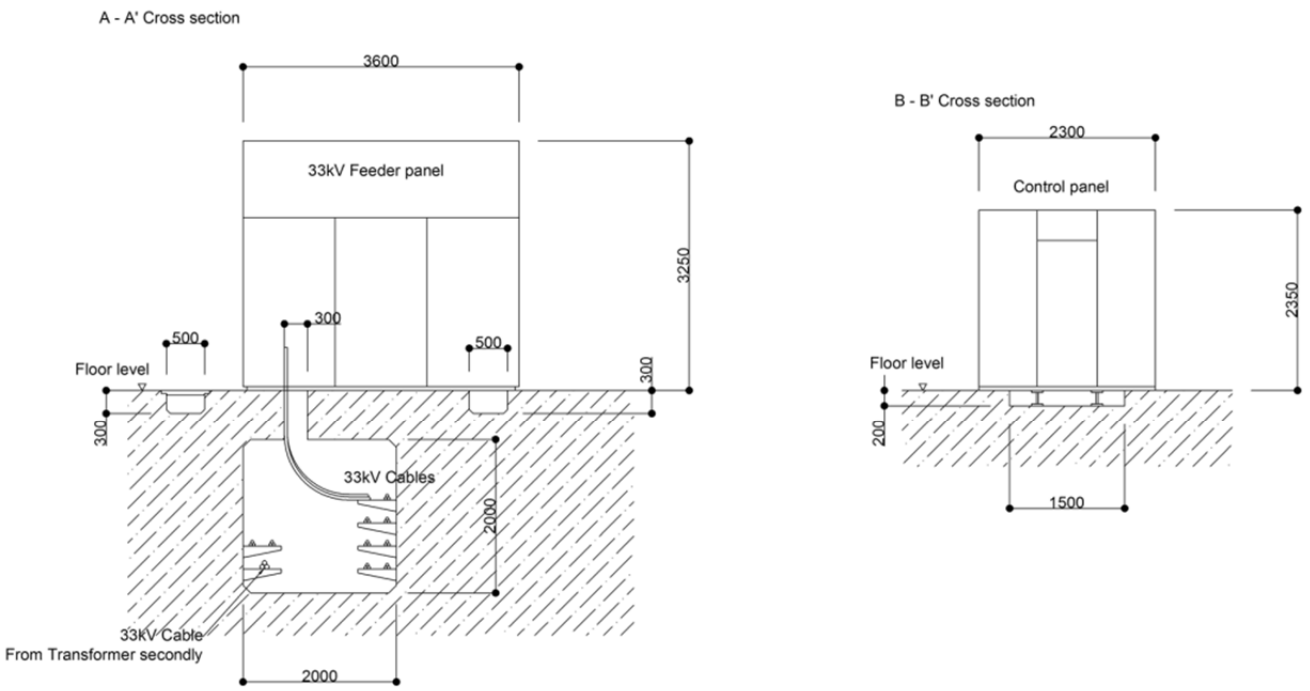
DWG TITLE: Control building layout plan for the Namialo substation

DWG NO.: N-06

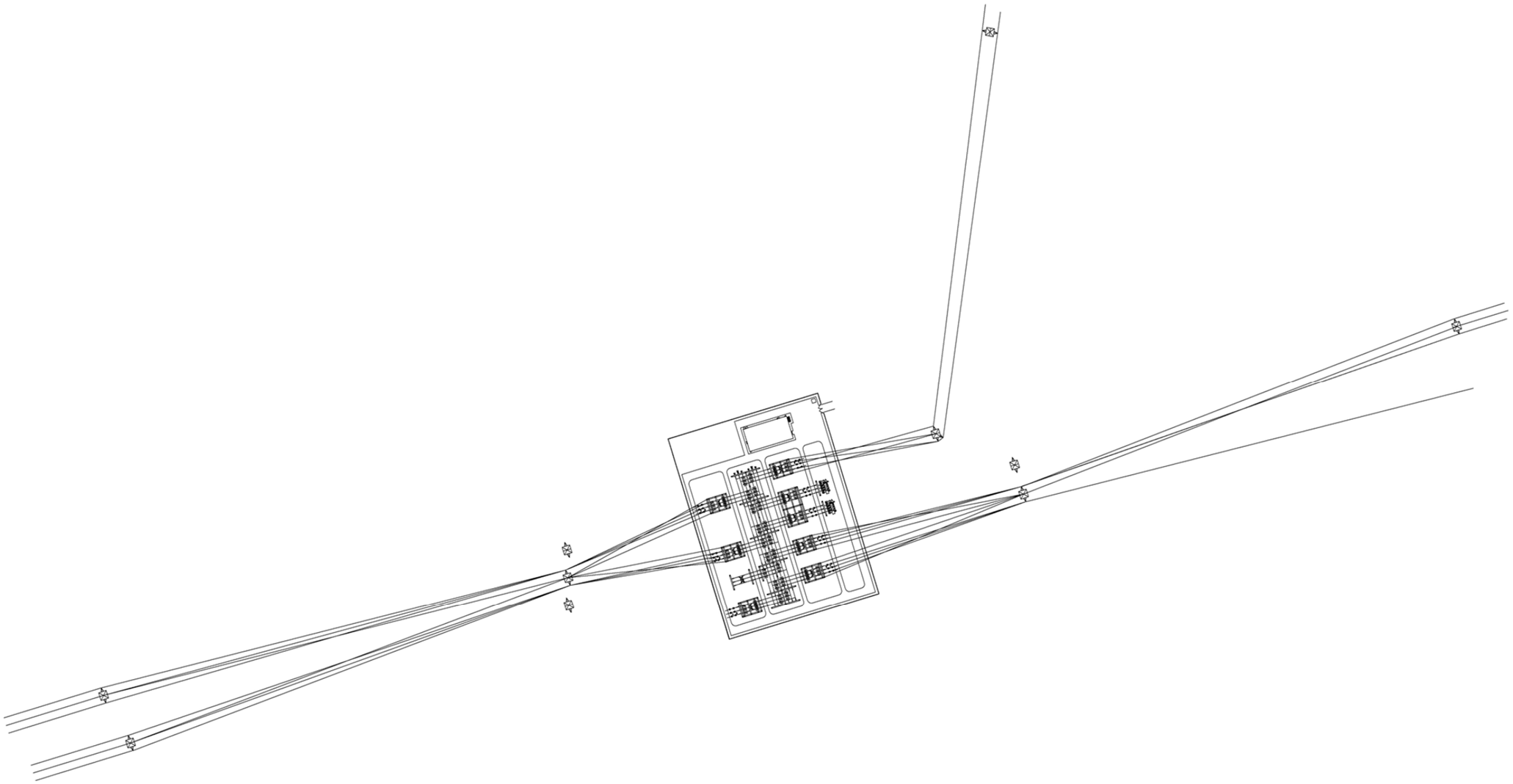
Oriental Consultants Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.



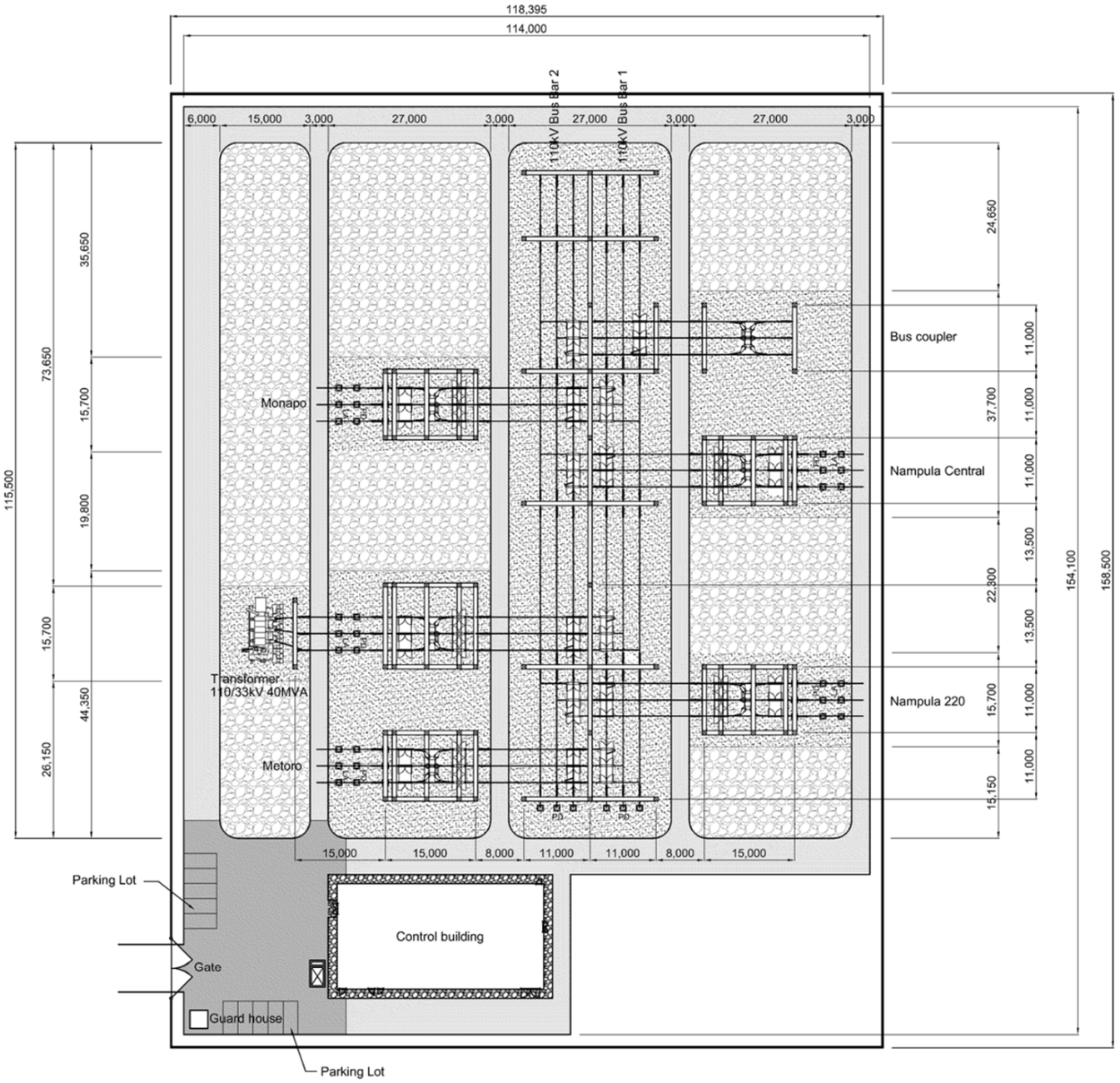
PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE: None	DWG. TITLE: Control building pit layout plan for the Namialo substation	DWG. NO.: N-07
			DATE: Dec. 2014		
				Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: None DATE: Dec. 2014	DWG. TITLE: Control building cross section plan for the Namialo substation	DWG. NO.: N-08
			Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	REVISIONS (NO. / DATE / DESCRIPTIONS / BY / APPD)	SCALE: None DATE: Dec. 2014 DRAWN BY CHECKED BY	DWG. TITLE: Transmission lines route plan around the Namialo substation DWG. NO.: N-09 Oriental Consultants Global Co.,Ltd. / TEPSCO Tokyo Electric Power Services Co.,Ltd.



Legends:

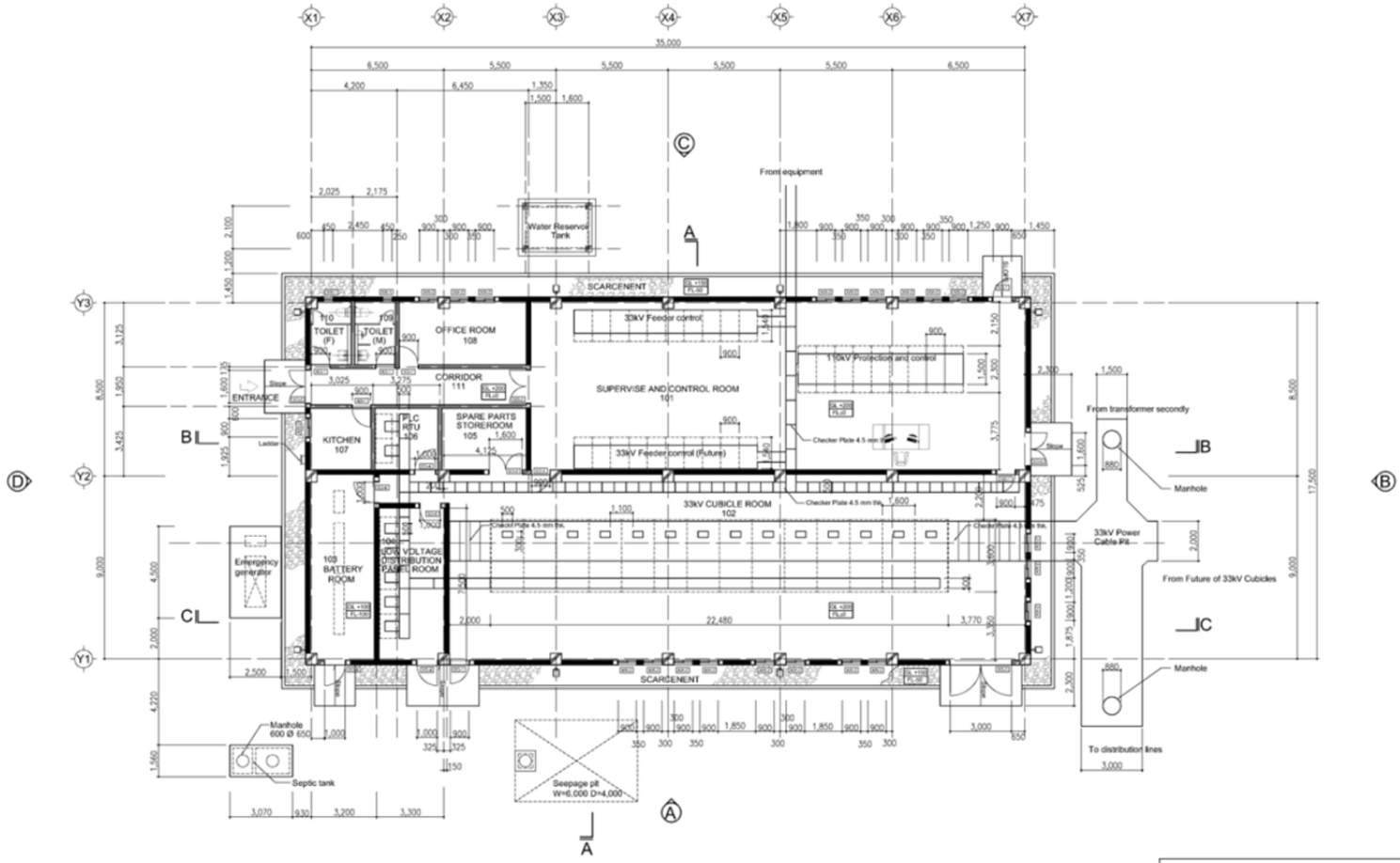
- Gravel Pavement
- Gravel Laying t=200 mm (Gravel Size 40 - 50 mm)
- Gravel Laying t=100 mm (Gravel Size 40 - 50 mm)
- Gravel Laying t=100 mm (Gravel Size 20 - 50 mm)
- Concrete Pavement
- Grading

Note:

Gate and Boundary Fence shall be constructed by EDM.

Site Area : 18,765 m^2

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE 1/750; DATE Nov. 2014; DRAWN BY; CHECKED BY	DWG. TITLE: SITE LAYOUT & PAVEMENT PLAN	DWG. NO. A-01
		NO. DATE DESCRIPTIONS BY APP'D REVISIONS	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

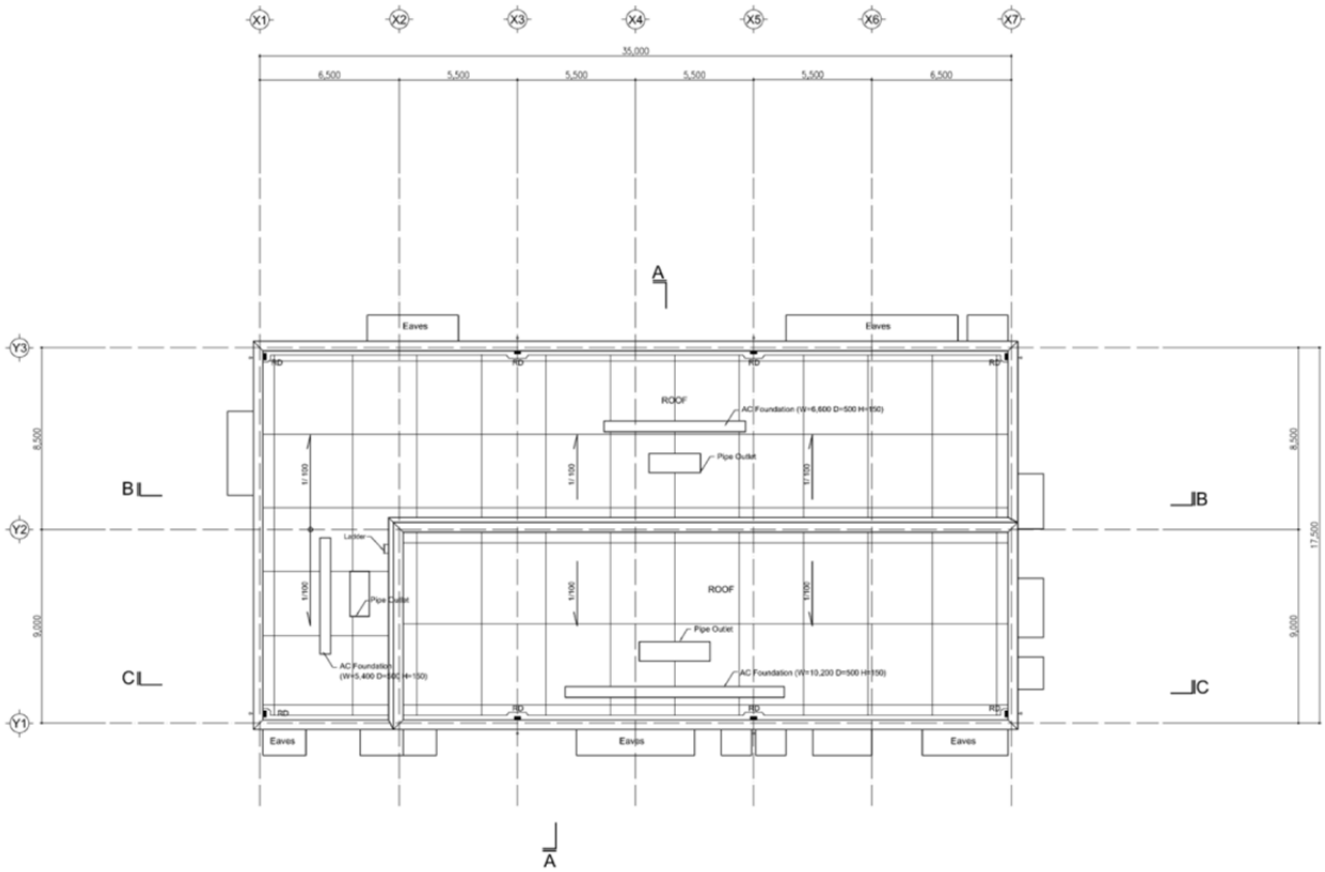


GROUND FLOOR PLAN

LEGEND :

- RC
- CB t=200mm (1 hour fire resisted wall)
- CB t=150mm
- Gravel

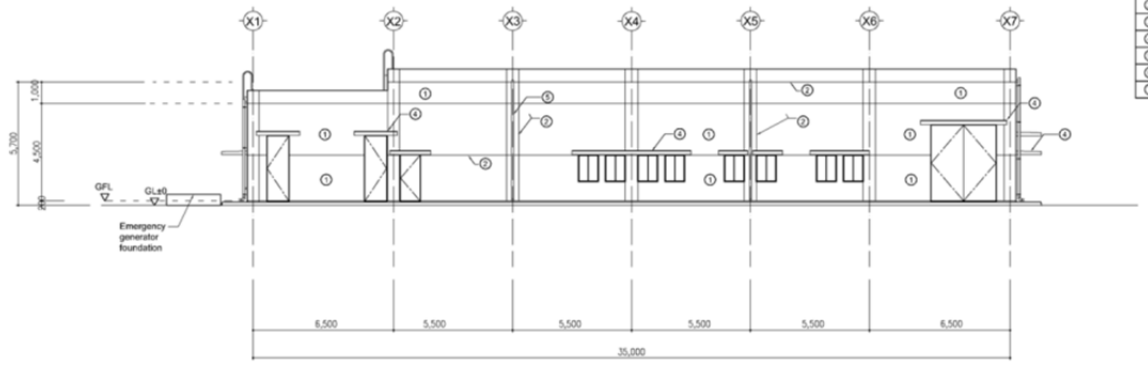
PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE: The layout and size of each equipment and furniture is reference.	REVISIONS	SCALE: 1/200	DWG. TITLE: GROUND FLOOR PLAN	DWG. NO.: A-02
			DATE: Nov. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



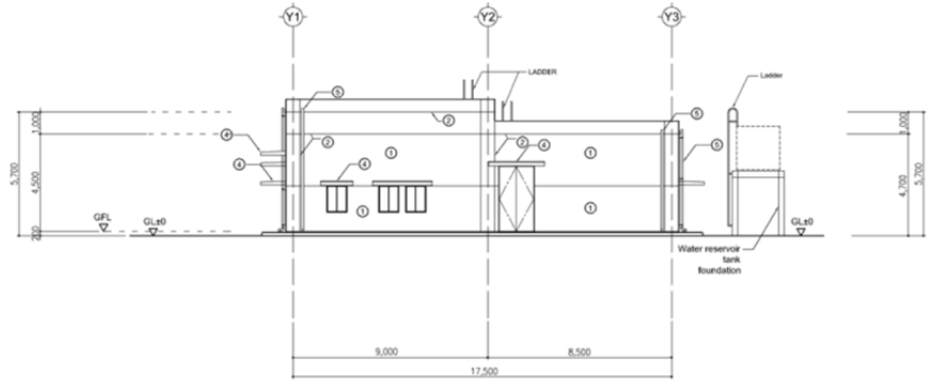
ROOF PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE: The layout and size of each equipment and furniture is reference.	SCALE: 1/200 DATE: Nov. 2014	DWG. TITLE: ROOF PLAN	DWG. NO.: A-03
			Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

NO.	MATERIAL / FINISH
①	ACRYLIC TEXTURE COAT
②	FALSE JOINT (CAULKING)
③	ANODIZED ALUMINIUM LOUVER
④	WATERPROOFING MORTAR t=25
⑤	RAIN LEADER : PVC 100Ø
⑥	
⑦	



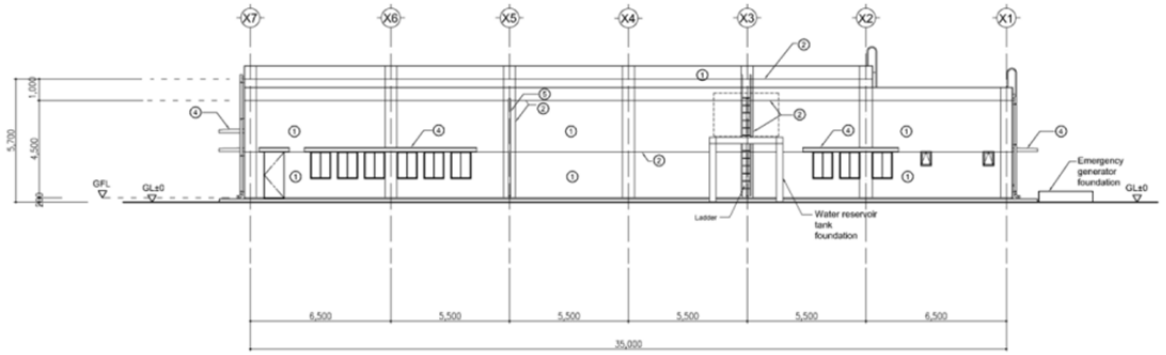
A ELEVATION



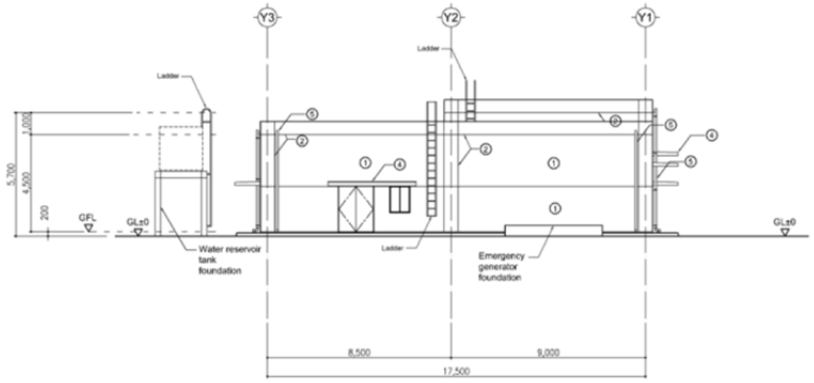
B ELEVATION

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE: The layout and size of each equipment and furniture is reference.	REVISIONS	SCALE: 1/200 DATE: Nov. 2014	DWG. TITLE: A ELEVATION & B ELEVATION — DWG. NO.: A-04
				Oriental Consultants Global Co.,Ltd. / Tokyo Electric Power Services Co.,Ltd.

NO.	MATERIAL / FINISH
1	ACRYLIC TEXTURE COAT
2	FALSE JOINT (CAULKING)
3	ANODIZED ALUMINIUM LOUVER
4	WATERPROOFING MORTAR t=25
5	RAIN LEADER : PVC 100Ø
6	
7	

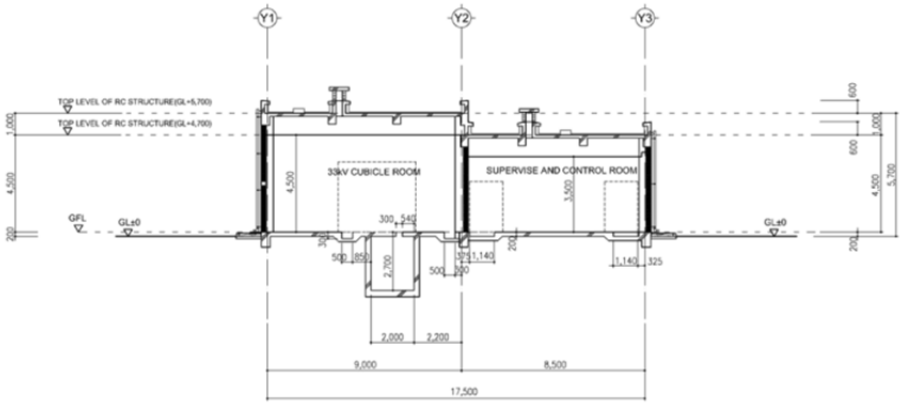


C ELEVATION

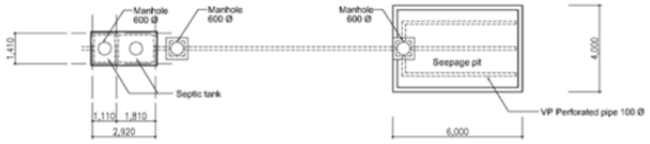


D ELEVATION

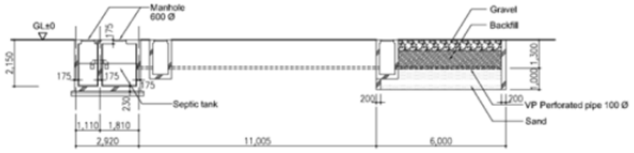
PROJECT TITLE	PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE
GENERAL NOTE	The layout and size of each equipment and furniture is reference.
REVISIONS	NO. / DATE / DESCRIPTIONS / BY / APPR
SCALE	1/200
DATE	Nov. 2014
DRAWN BY	
CHECKED BY	
DWG. TITLE	C ELEVATION & D ELEVATION
DWG. NO.	A-05
	Oriental Consultants Global Co.,Ltd. / Tokyo Electric Power Services Co.,Ltd.



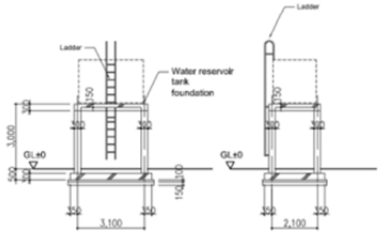
A - A SECTION



SEPTIC TANK & SEEPAGE PIT PLAN



SEPTIC TANK & SEEPAGE PIT SECTION

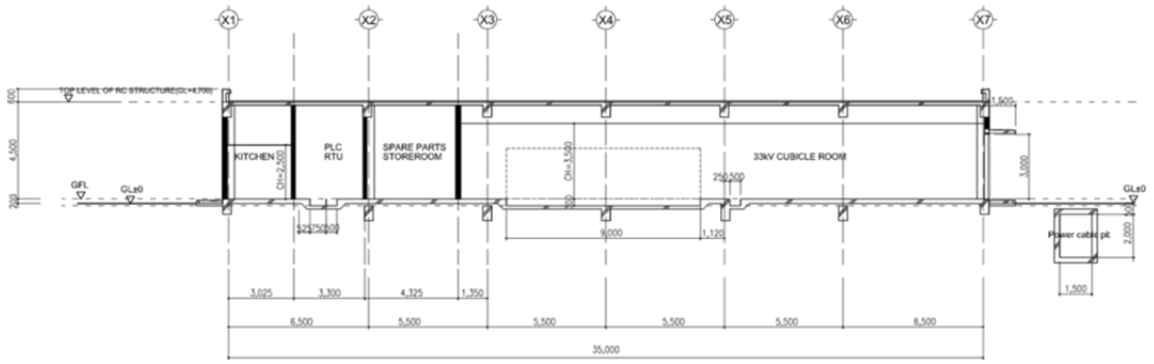


WATER RESERVOIR TANK SECTION

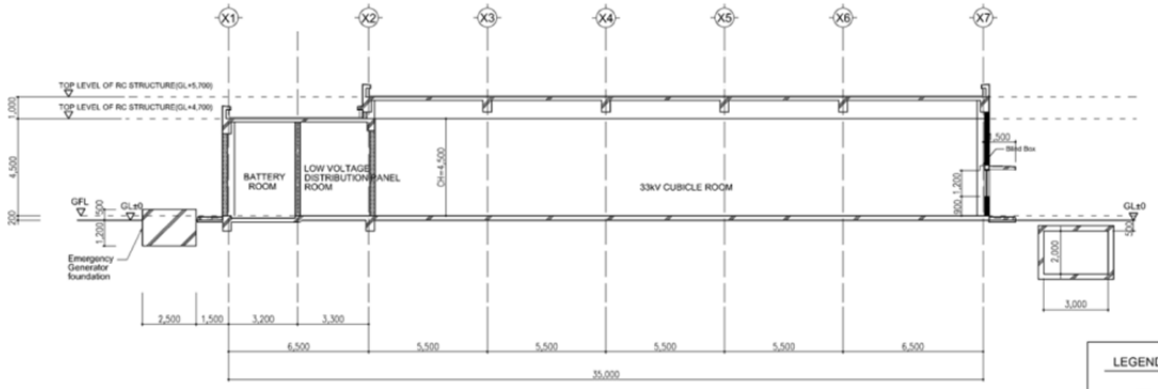
LEGEND :

- RC
- CB t=200mm (1 hour fire resisted wall)
- CB t=150mm
- Gravel

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE: The layout and size of each equipment and furniture is reference.	REVISIONS	SCALE: 1/200	DWG. TITLE: A - A SECTION / SEPTIC TANK PLAN & SECTION	DWG. NO.: A-06
			DATE: Nov. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



B - B SECTION

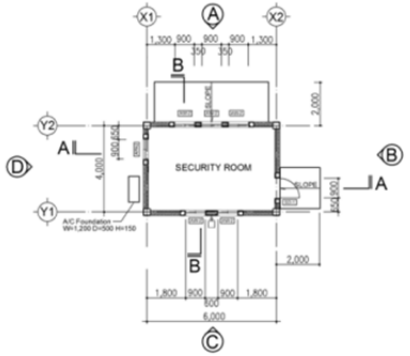


C - C SECTION

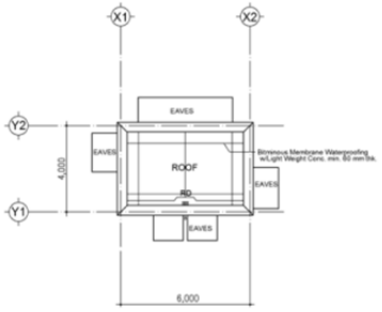
LEGEND :

- RC
- CB t=200mm (1 hour fire resisted wall)
- CB t=150mm
- Gravel

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE: The layout and size of each equipment and furniture is reference.	SCALE: 1/200	DWG. TITLE: B -B SECTION & C - C SECTION	DWG. NO.: A-07
		DATE: Nov. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



GROUND FLOOR PLAN

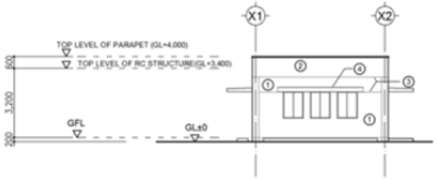


ROOF PLAN

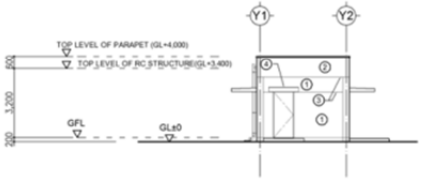
NO.	EXTERNAL FINISH
1	MORTAR TROWEL w/ACRYLIC TEXTURE COAT
2	MORTAR TROWEL w/ACRYLIC TEXTURE COAT
3	FALSE JOINT (CAULKING)
4	WATERPROOFING MORTAR t=25
5	RAIN LEADER : PVC 100Ø

NO.	INTERNAL FINISH SCHEDULE	
A	FLOOR	CONCREETE TROWEL w/DUSTPROOF PAINT
B	SKIRTING	AEP H=100
C	WALL	MORTAR TROWEL w/AEP
D	CEILING	AEP
E	DESCRIPTION	

DOOR & WINDOW SCHEDULE



A ELEVATION



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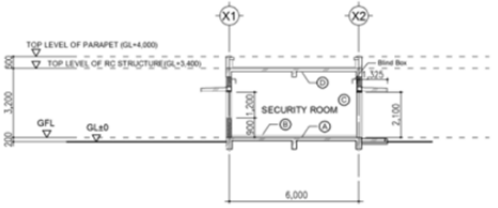
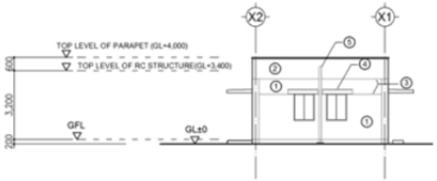


A - A SECTION



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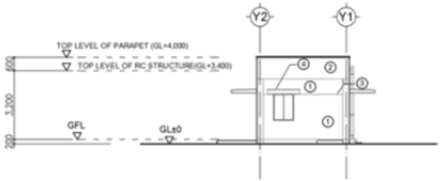
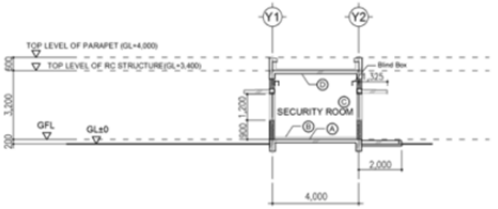


D ELEVATION



B - B SECTION

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE: 1/200	DWG. TITLE: GUARD HOUSE	DWG. NO.: A-08
			DATE: Nov. 2014		
		NO. DATE DESCRIPTION BY APP'D REVISIONS		Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

EXTERIOR FINISH SCHEDULE

ROOF	FLAT ROOF	CONCRETE TROWEL, BITMINOUS MEMBRANE WATERPROOFING, LIGHT WEIGHT CONCRETE MINIMUM t=60	WALL	CB WALL CONCRETE COLUMN & BEAM FALSE JOINT(caulking)	MORTAR TROWEL t=25 w/ACRYLIC TEXTURE COAT MORTAR TROWEL t=25 w/ACRYLIC TEXTURE COAT w=25 d=20
	ROOF DRAIN RAIN LEADER	CAST IRON PVC PIPE 100 φ	WINDOW DOOR LOUVER	FRAME FRAME GLASS	ALUMINUM ALUMITE(COLOR ANODIZED) STEEL w/SOP ALUMINUM ALUMITE(COLOR ANODIZED) FLOAT GLASS PATTERNED GLASS
	LADDER	STRINGR: STAINLESS STEEL 50 φ, RUNG: STAINLESS STEEL 20 φ @350	SLOPE	FLOOR	CONCRETE w/NON SLIP SLIT
	EAVES	WATEPROOFING MORTAR MINIMUM t=60			

EXTERNAL FINISH SCHEDULE

SCARCEMENT SPLASH BLOCK	GRAVEL 20 φ to 50 φ PC CONCRETE 300 x 350 x 50
CURBSTONE	PRE- CAST CONCRETE 150x200
UNDERNEATH OF FLOOR SLAB	POLYETHYLENE SHEET t=0.05

INTERIOR FINISH SCHEDULE

FLOOR	Rm No.	ROOM NAME	FLOOR			BASEBOARD		WALL	CEILING			BLIND BOX CURTAIN BOX (S):SINGLE RAIL (W):DOUBLE RAIL	FLOOR AREA (in ㎡)	REMARKS
			MATERIAL/FINISH	CONC. LEVEL	FINISH LEVEL	MATERIAL/FINISH	H	MATERIAL/FINISH	MATERIAL/FINISH	CEILING HEIGHT	CEILING MOLD			
GROUND FLOOR	101	SUPERVISE & CONTROL ROOM	CONCRETE TROWEL DUST-PROOF PAINT	±0	±0	MORTAR TROWEL w/AEP	100	MORTAR TROWEL t=25 w/AEP	SYSTEM CEILING ROCKWOOL ACOUSTIC BOARD t=15.0	3,500	PLASTIC	BLIND BOX —		GALVANAIZED CHECKER PLATE t=4.5
	102	33kV CUBICLE ROOM	ditto	±0	±0	ditto	100	ditto	ditto	4,500	PLASTIC	BLIND BOX		GALVANAIZED CHECKER PLATE t=4.5
	103	LOW VOLTAGE DISTRIBUTION PANEL ROOM	ditto	±0	±0	ditto	100	ditto	AEP		—	—		GALVANAIZED CHECKER PLATE t=4.5
	104	BATTERY ROOM	CONCRETE TROWEL ACID-RESISTANT PAINT	±0	±0	MORTAR TROWEL w/ ACID-RESISTANT PAINT	300	ditto	ditto			—		
	105	SPARE PARTS STORAGE	CONCRETE TROWEL DUST-PROOF PAINT	±0	±0	MORTAR TROWEL w/AEP	100	ditto	ditto			—		
	106	PLC RTU	ditto	±0	±0	ditto	100	ditto	ditto			—		GALVANAIZED CHECKER PLATE t=4.5
	107	KITCHEN	CONCRETE TROWEL PVC SHEET t=2.0	±0	±0	SOFT PVC	100	ditto	ALUMINUM T-BAR ROCKWOOL ACOUSTIC BOARD t=15.0	2,500	PLASTIC	—		KITCHEN SINK SET w/TOP CABINET
	108	OFFICE ROOM	ditto	-150	±0	ditto	100	ditto	ditto	2,500	PLASTIC	BLIND BOX		
	109 110	TOILET (M) TOILET (F)	MORTAR SETTING BED NON SLIP CERAMIC TILE 300x300	-150	-50~ -80	—		CERAMIC TILE 300x300	CMB t=5.0 w/VP	2,500	PLASTIC	—		BASIN, URINAL, MIRROR, TOILET BOOTH PARTITION LINING: CERAMIC TILE
	111	CORRIDOR	CONCRETE TROWEL DUST-PROOF PAINT	±0	±0	MORTAR TROWEL w/AEP	100	MORTAR TROWEL t=25 w/AEP	ALUMINUM T-BAR ROCKWOOL ACOUSTIC BOARD t=15.0	2,500	PLASTIC	—		

ABBREVIATIONS

CONC	: CONCRETE	LGS	: LIGHT GAUGE STEEL (ready made stud/furring)	PB	: PLASTER BOARD	PVC	: POLYVINYL CHLORIDE	AEP	: ACRYLIC EMULSION PAINT	UC	: POLYURETHANE PREPOLYMER (TWO PACK REACTIVE TYPE)
CB	: CONCRETE BLOCK	WJ	: WALL JOINT METHOD (TAPERED BOARD WITH BUTT JOINTS)	CMB	: FLEXIBLE CEMENT BOARD (non-asbestos)	PVC (L)	: LAMINATED SHEET(TILE)	SOP	: SYNTHETIC RESIN OIL PAINT	EX	: CO-POLYMER EPOXY RESIN
BR	: BRICK	FB	: FLAT BAR	RWB	: ROCK WOOL ACOUSTIC BOARD (shop coat with nominated color)	PVC (H)	: HOMOGENEOUS SHEET(TILE)	VP	: VINYL RESIN ENAMEL		
SS	: STRUCTURAL STEEL	SUS	: STAINLESS STEEL			GW	: GLASS WOOL	OS	: OIL STAIN		
W	: WOOD (Stud/furring)	HL	: HAIR LINE FINISH	wp	: WATER-PROOF	SC	: SYSTEM CEILING	CL	: CLEAR LACQUER		
		BP	: BUFF POLISH FINISH								

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

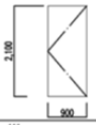
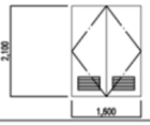
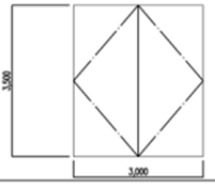
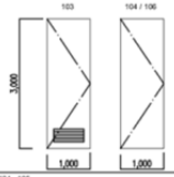
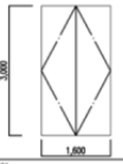
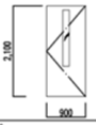
SCALE: —
DATE: Nov. 2014
DRAWN BY
CHECKED BY

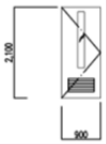
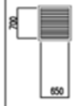
DWG. TITLE: CONTROL BUILDING FINISH SCHEDULE

DWG. NO.: A-09

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.

SYMBOL/TYPE	AW-1 PROJECTION WINDOW	AW-2 SLIDING WINDOW				
SHAPE						
LOCATION	109 110	101 102 107 108				
QUANTITY	2	21				
MATERIAL /FINISH	ALUMINIUM ALUMITE 3 MM THK	ALUMINIUM ALUMITE 3 MM THK				
FRAME	ditto FRAME SIZE : 100x30	ditto FRAME SIZE : 100x30				
SILL						
GLASS	CLEAR FLOAT t=6.0	CLEAR FLOAT t=6.0				
LOCK	BH L-H	CR				
HARD WARES						
REMARKS						

SYMBOL/TYPE	SD-1 SLIDING LEAF SWING DOOR	SD-2 DOBLE LEAF SWING DOOR	SD-3 DOUBLE LEAF SWING DOOR	SD-4 SINGLE LEAF SWING DOOR	SD-5 DOUBLE LEAF SWING DOOR	SD-6 SINGLE LEAF SWING DOOR	SD-7 DOUBLE SWING DOOR
SHAPE							
LOCATION	101 111	105 111	105	103 104 106	101	103 104	108
QUANTITY	2	3	1	3	1	2	1
MATERIAL /FINISH	St PL t=1.6 SOP	St PL t=1.6 SOP	St PL t=1.6 SOP	St PL t=1.6 SOP	St PL t=1.6 SOP	St PL t=1.6 SOP	St PL t=1.3 SOP
FRAME	St PL t=1.6 SOP FRAME SIZE : 100x25	St PL t=2.3 SOP FRAME SIZE : 100x25	St PL t=2.3 SOP FRAME SIZE : 200x50	St PL t=1.6 SOP FRAME SIZE : 100x25	St PL t=2.3 SOP FRAME SIZE : 200x50	St PL t=1.6 SOP FRAME SIZE : 100x25	St PL t=1.6 SOP FRAME SIZE : 100x25
SILL	SUS t=1.5	SUS t=1.5	SUS t=1.5	SUS t=1.5	SUS t=1.5	SUS t=1.5	SUS t=1.5
GLASS							PATTERNED t=6.0
LOCK	C-LOCK with TT	C-LOCK	H-LOCK	C-LOCK w/TT	H-LOCK	C-LOCK w/TT	C-LOCK w/TT
HARD WARES	BH L-H DC DS	BH L-H E-B DC DS	BH B-H E-B DS	BH L-H DC DS	BH B-H E-B DS	BH L-H DC DS	BH L-H DC DS
REMARKS		LOUVER INSTAL FOR THE DOOR AT ROOM 105					

SYMBOL/TYPE	AD-1 SINGLE LEIF SWING DOOR + LOUVER		AW-1 PANEL FLASH DOOR for BOOTH			AL-1 LOUVER
SHAPE						
LOCATION	107 109 110		109 110	111		107
QUANTITY	3		2	2		1
MATERIAL /FINISH	ALUMINIUM ALUMITE 3 MM THK		PVC PLYSTER DECORATED FLUSH DOOR (HIS/PAPER CORE)	St Slat t=1.6 SOP		ALUMINIUM ALUMITE
FRAME	ditto FRAME SIZE : 100x30		ALUMINIUM ALUMITE	Guide Rail Stainless steel t=2.0		ditto FRAME SIZE : 100x50
SILL	SUS t=1.5			Stainless Steel Flat Bar t=9.0		
GLASS	PATTERNED t=5.0					
LOCK	C-LOCK		LAVATORY LATCH, INDICATOR			
HARD WARES	BH L-H DC DS		PH(CENTER HANG) DOOR HOOK AND BUMPER TOP JOINT, BOTTOM STAND			
REMARKS				Steel Plate Case		

ABBREVIATIONS	HINGE	HANDLE	LOCK		
	BH : BUTT HINGE	C-H : CASE HANDLE	C-LOCK : CYLINDER LOCK	CR : CRESCENT LATCH	DC : DOOR CHECK
	FH : FLOOR HINGE	B-H : BAR HANDLE	H-LOCK : HOOK LOCK	TT : THUMB TURN	DS : DOOR STOPPER
	GH : GRAVITY HINGE	L-H : LEVER HANDLE	C-BOLT : CREMONE BOLT		
	PH : PIVOT HINGE	N-H : KNOB HANDLE	E-BOLT : EXTENSION BOLT		

NOTE

1: UNLESS OTHERWISE SPECIFIED HARE WARES ARE SUS304

2: LOUVER OPEN RATIO IS 30%

3: PLYWOOD SHOULD BE WATERPROOFED

PROJECT TITLE

PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

NO.	DATE	DESCRIPTIONS	BY	APP'D

SCALE 1/200

DATE Nov. 2014

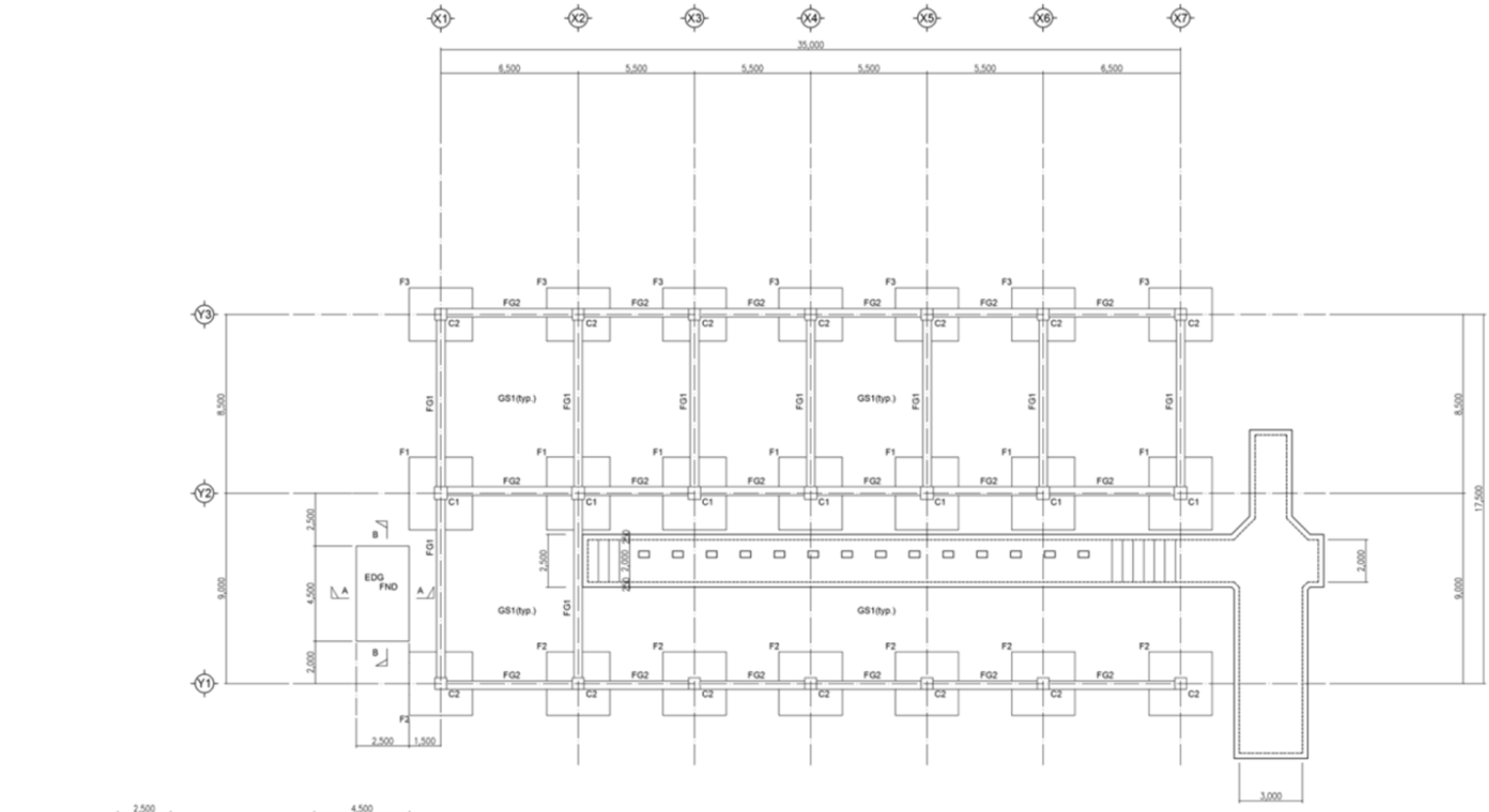
DRAWN BY

CHECKED BY

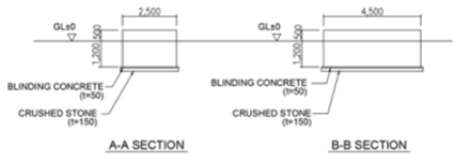
DWG. TITLE OPENING SCHEDULE

DWG. NO. A-10

Oriental Consultants Global Co.,Ltd. Tokyo Electric Power Services Co.,Ltd.



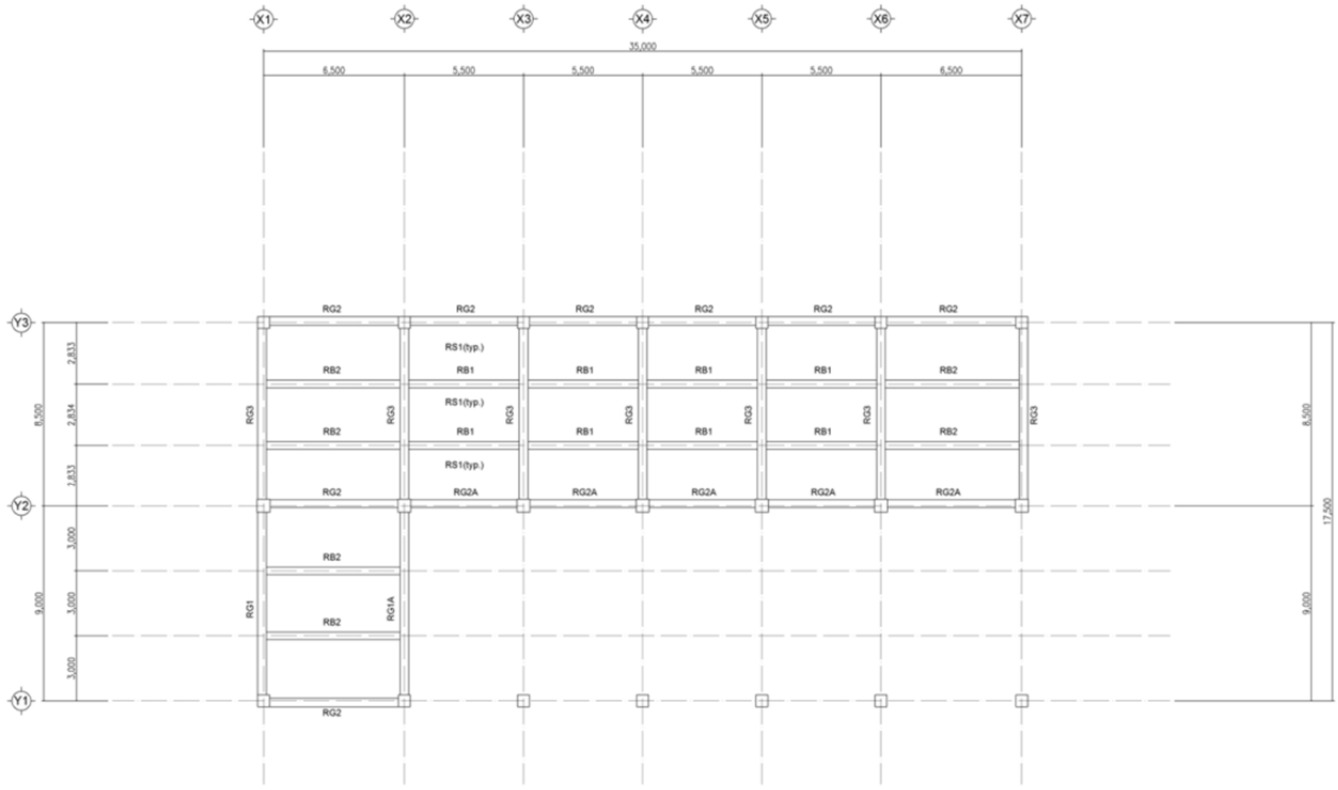
FOUNDATION PLAN



A-A SECTION

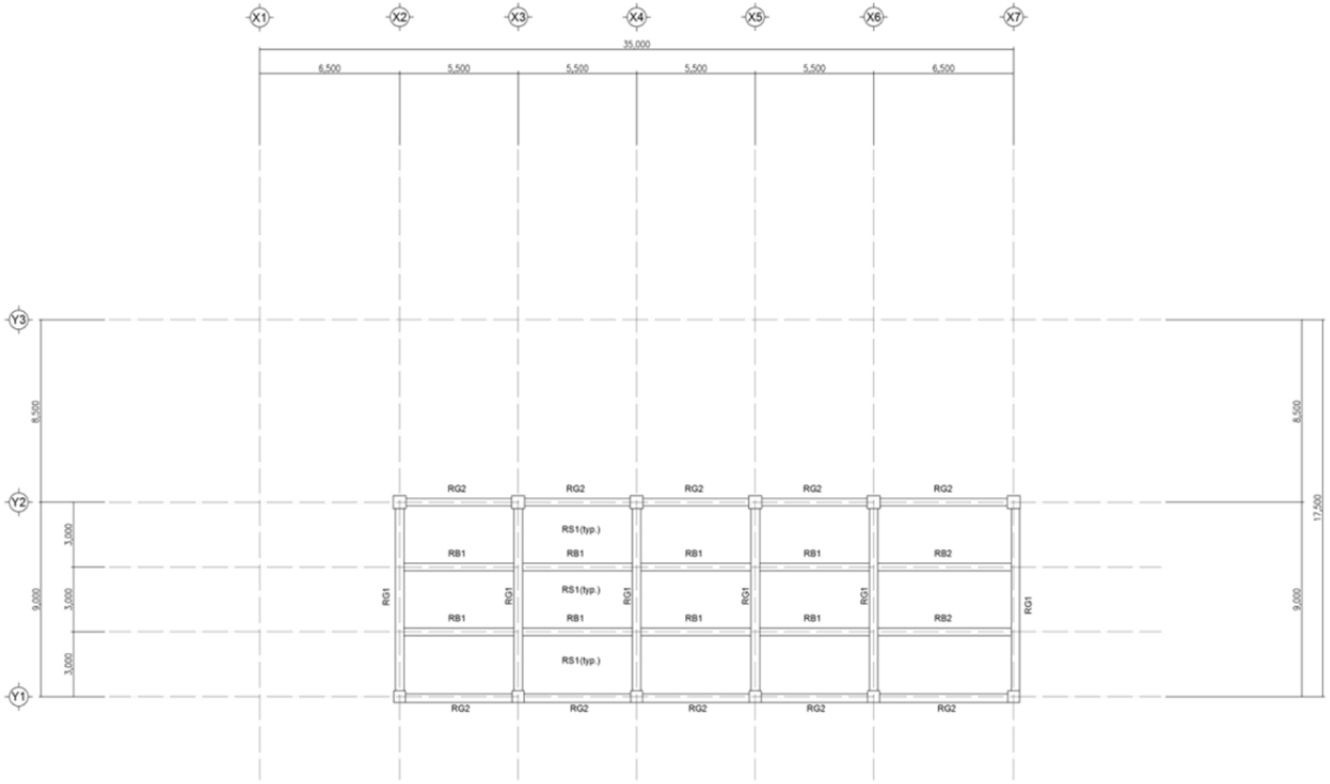
B-B SECTION

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE: 1/200	DWG. TITLE: FOUNDATION PLAN	DWG. NO.: S-01
			DATE: Jul. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,ltd



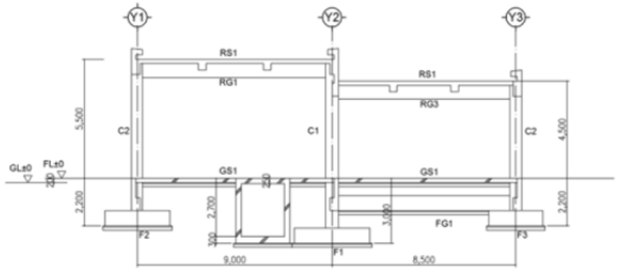
FL+4,500 ROOF FRAMING PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE 1/200	DWG. TITLE FL+4,500 ROOF FRAMING PLAN	DWG. NO. S-02
			DATE Jul. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,ltd

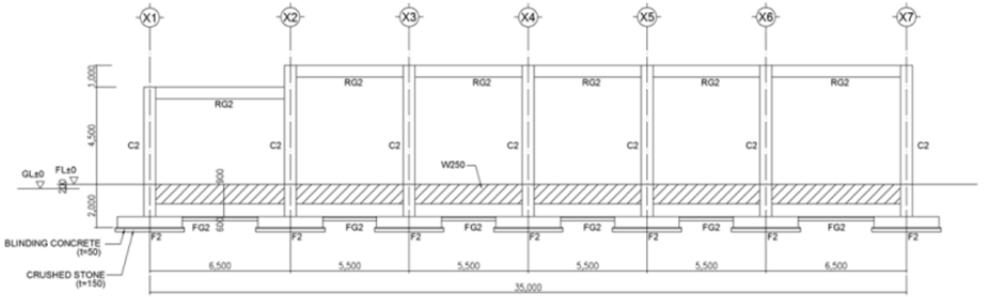


FL+5,500 ROOF FRAMING PLAN

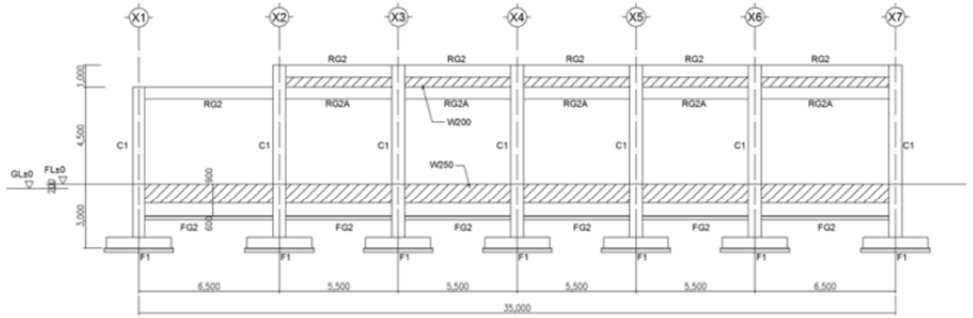
PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: 1/200 DATE: Jul. 2014	DWG. TITLE: FL+5,500 ROOF FRAMING PLAN	DWG. NO: S-03
			Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,ltd



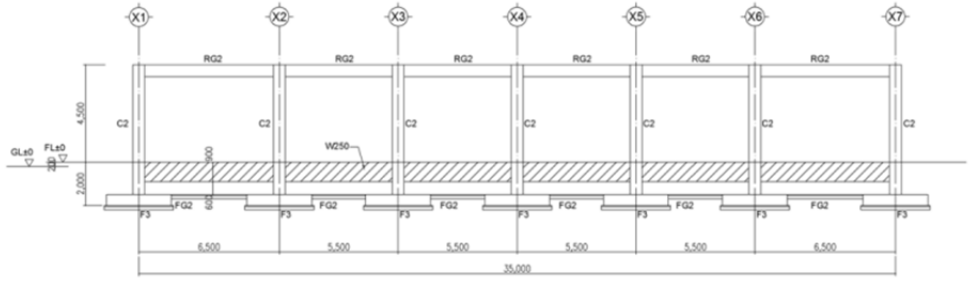
X5 LINE FRAMING ELEVAION



Y1 LINE FRAMING ELEVAION



Y2 LINE FRAMING ELEVAION



Y3 LINE FRAMING ELEVAION

MEMBER SCHEDULE

MEMBER	SECTION
FG1	400x700
FG2	400x600
RB1	350x500
RB2	350x550
RG1	400x700
RG2	350x550
RG1A	400x700
RG2A	350x550
RG3	400x700
C1	600x550
C2	550x550
F1	3000x3500x500(H)
F2	3000x3000x500(H)
F3	3000x2500x500(H)
W200	t=200
W250	t=250
GS1	t=200
RS1	t=130

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

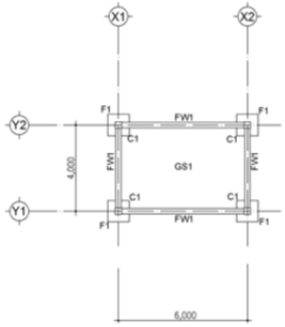
GENERAL NOTE

SCALE 1/200
DATE Jul. 2014

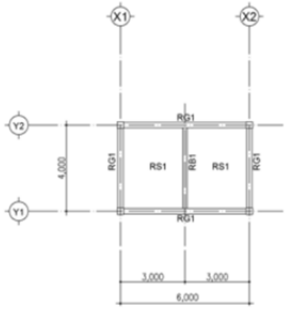
DWG TITLE FRAMING ELEVAION

DWG NO. S-04

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,ltd



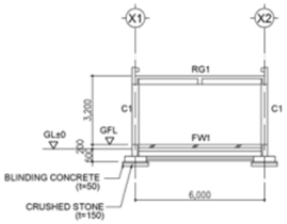
FOUNDATION PLAN



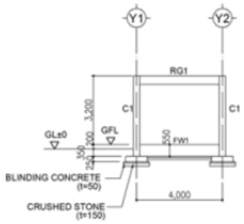
ROOF FRAMING PLAN

MEMBER SCHEDULE

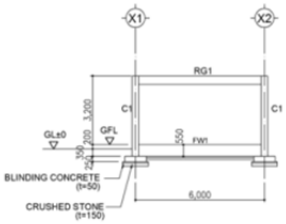
MEMBER	SECTION
FW1	250x550
RB1	200x400
RG1	250x400
C1	300x300
F1	1000x1000x250(H)
GS1	t=150
RS1	t=130



SECTION



X1 LINE FRAMING ELEVATION



Y1 LINE FRAMING ELEVATION

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

SCALE 1/200
DATE Aug. 2014

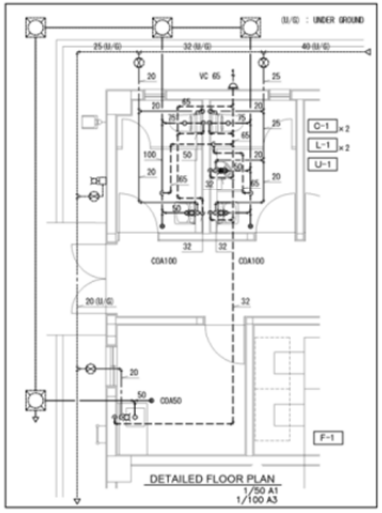
DWG. TITLE
GUARD HOUSE FRAMING PLAN & ELEVATION

DWG. NO.
S-05

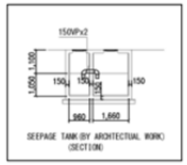
Oriental Consultants Global Co.,Ltd.
Tokyo Electric Power Services Co.,Ltd.

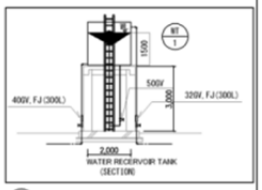
LEGEND

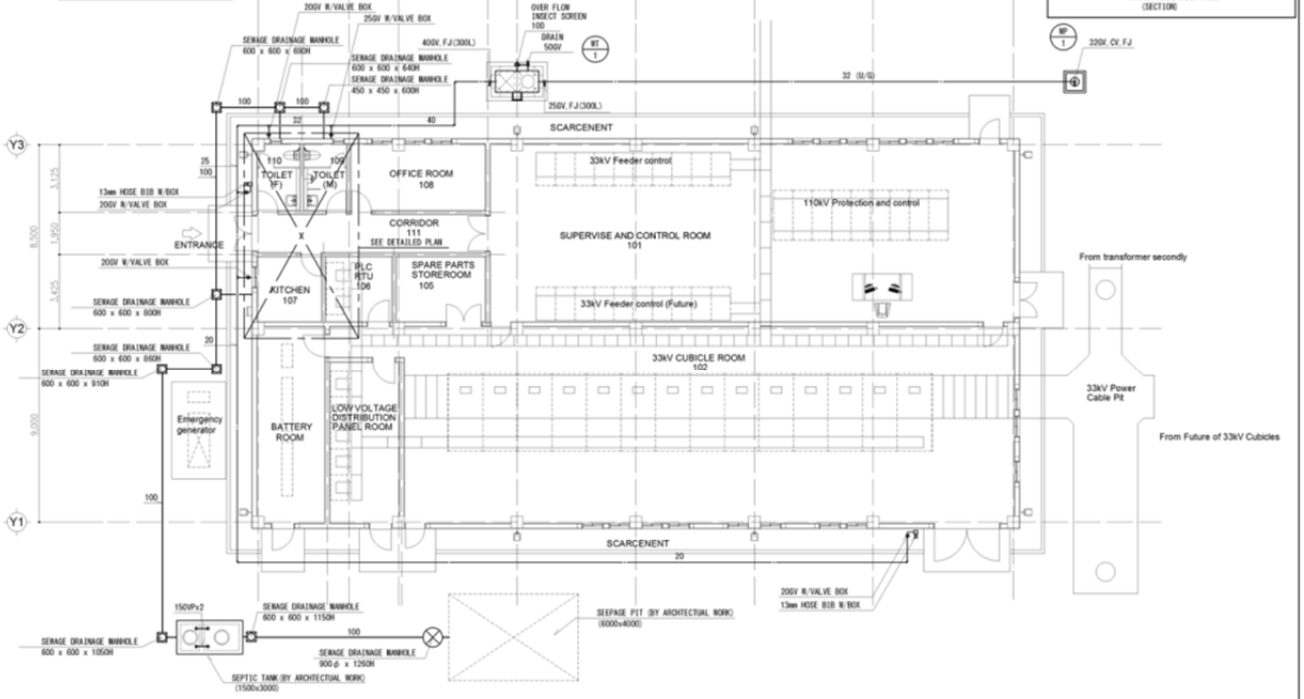
SYMBOL	DESCRIPTION	MATERIAL
—— - ——	WATER SUPPLY PIPE	P.V.C (V.P)
————	WASTE & SOIL PIPE	P.V.C (V.P)
- - - - - - - - -	VENT PIPE	P.V.C (V.P)
	FLEXIBLE JOINT	
	GATE VALVE	
	BALL VALVE	
	CHECK VALVE	
	STRAINER	
	FAUCET	FOR WATER
	GARDEN FAUCET	W/ BOX
	FLOOR DRAIN	
	CLEAN OUT	ON THE FLOOR
	CLEAN OUT	UNDER THE FLOOR
	CATCH BASIN (WASTE WATER)	
	CATCH BASIN (SOIL WATER)	INVERT TYPE
	FOOT VALVE	
BT	BALL TAP	
ABC	MULTIPURPOSE CHEMICAL FIRE EXTINGUISHER	



DETAILED FLOOR PLAN
1/50 A1
1/100 A3







EQUIPMENT SCHEDULE FOR PLUMBING SYSTEM

Equip. No.	Name	Specification	Location	Elect Data			Q'TY	Remarks
				Φ (PH)	VOLT	kW		
WT-1	WATER RECERVOIR TANK FRP MADE	CAP. : 4.0 m3 (3.0 m3)	OUTDOOR	–	–	–	1SET	CONCRETE FOUNDATION (BY CIVIL)
		DIMENSION : 2.0 m × 1.0m × 2.0mH						
		STEEL FRAME TRESTLE : 3.0mH						
WP-1	DEEP WELL PUMP	CAP. : 32 ϕ 100 l/min x 0.3MPa	OUTDOOR	3	380	1.5	1SET	
		SUBMERSIBLE PUMP						
		ACCESSORY : CONTROL PANEL, ELECTRICAL CABLE ETC.						

SANITARY FIXTURE EQUIPMENT LIST

Equip. No.	Sanitary Fixture Name	Model No.
C-1	WATER CLOSET (WESTERN TYPE)	WASH DOWN TYPE LOW TANK
	PAPER HOLDER	
U-1	URINALS	WALL HUNG TYPE
L-1	LAVATORY	WALL HUNG TYPE
SK-1	SERVICE SINK	
F-1	FAUCET	

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

NO.	DATE	DESCRIPTIONS	BY	APPD
		REVISIONS		

SCALE 1/200
DATE Aug. 2014
DRAWN BY
CHECKED BY

DWG. TITLE GROUND FLOOR PLAN FOR PLUMBING SYSTEM

DWG. NO. M-01

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.

EQUIPMENT SCHEDULE

AIR COOLED SPLIT AIR CONDITIONER

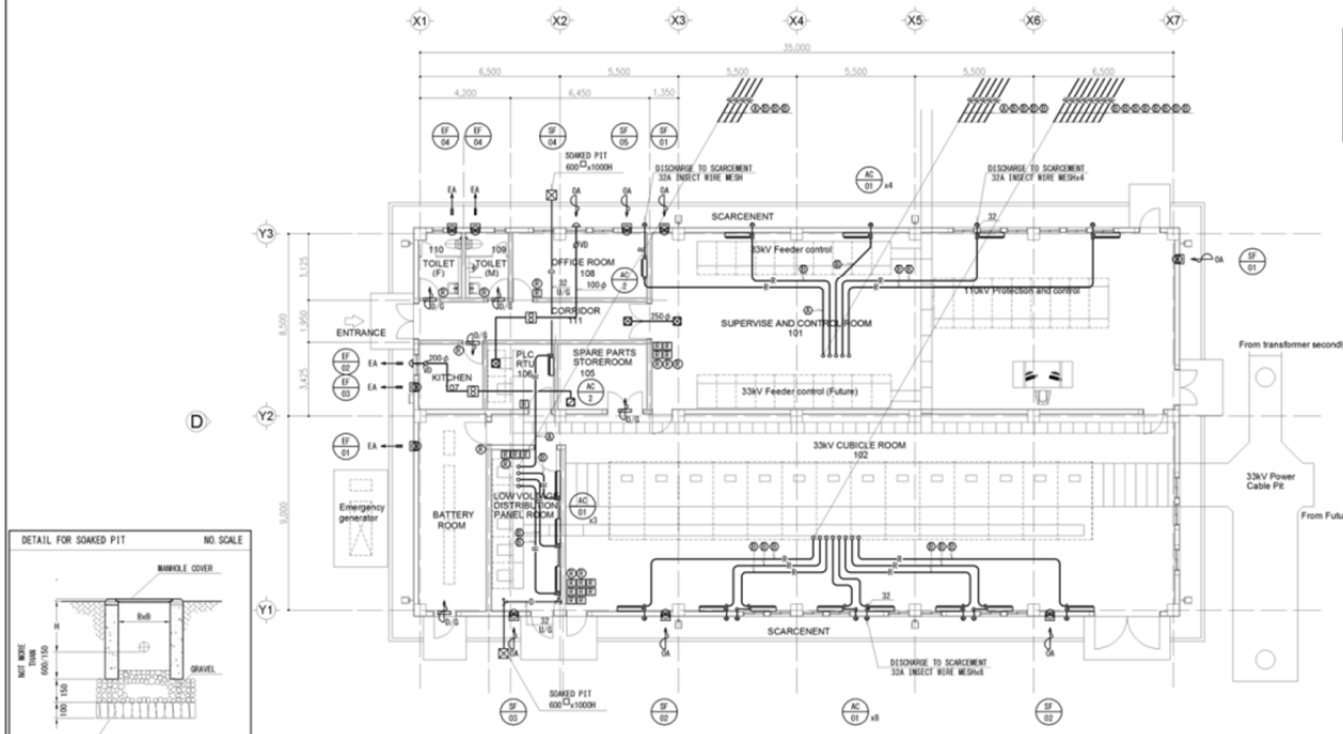
SERIAL NO.	TYPE	COOLING CAP. (DX COIL) TH (Kw)	HEATING CAP. (HEAT PUMP) TH (Kw)	SA (CMH)	ESP (Pa)	HUMIDIFIER TYPE	HUMIDIFIER OP. (kg/h)	POWER CONSUMPTION (1Φx220Vx50Hz) (W)	Q'TY	LOCATION	REMARKS
AC-01	WALL MOUNTED TYPE	9.0	-	-	-	-	-	3000	15	103 STAFF ROOM 104 SERVER ROOM	REFRIGELANT PIPE CONNECTION : 15.9Φ×9.5Φ (SUCTION × LIQUID)
AC-02	WALL MOUNTED TYPE	5.5	-	-	-	-	-	1900	2	102 MONITOR ROOM	REFRIGELANT PIPE CONNECTION : 12.7Φ×6.4Φ (SUCTION × LIQUID)

FAN

SERIAL NO.	TYPE	FLOW RATE (CMH)	ESP (Pa)	POWER (50 Hz) W	Φ	V	Q'TY	LOCATION	REMARKS
SF-01	PROPELLER FAN	750	20	120	1	220	2	101 SUPERVISE & CONTROL RM	C/W PRE-FILTER
SF-02	PROPELLER FAN	1200	20	150	1	220	2	102 33KV CUBICLE ROOM	C/W PRE-FILTER
SF-03	PROPELLER FAN	200	20	60	1	220	1	103 LOW VOL. DISTRIBUTION RM	C/W PRE-FILTER
SF-04	AXIAL FAN (LOW NOISE TYPE)	100	80	120	1	220	1	106 PLC RTU	
SF-05	PROPELLER FAN	120	20	60	1	220	1	108 OFFICE	C/W PRE-FILTER
EF-01	PROPELLER FAN	600	20	120	1	220	1	104 BATTERY ROOM	
EF-02	AXIAL FAN (LOW NOISE TYPE)	300	50	150	1	220	1	105 SPARE PARTS STORE ROOM	
EF-03	PROPELLER FAN	200	20	60	1	220	1	107 KITCHEN	
EF-04	PROPELLER FAN	170	20	60	1	220	2	TOILET(M), TOILET(F)	

LEGEND

SYMBOL	DESCRIPTION	MATERIAL
—— D ——	DRAINAGE PIPE	P.V.C (V.P) W/INSULATION
—— R ——	REFRIGERANT PIPE	COPPER (L) W/INSULATION
(R)	REMOTE CONTROL FOR FAN	
[R]	REMOTE CONTROL FOR AC	
[T]	THERMO SWITCH	
D.G.	DOOR GRILLE / GRILLE (BY ARCHITECTURAL WORK)	



GROUND FLOOR PLAN FOR A/C AND VENTULATION SYSTEM

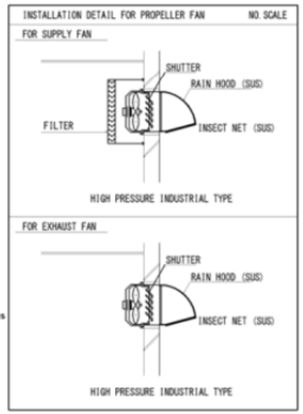
1/100 A1
1/200 A3

DIFUSER & REGISTERS LIST

ROOM No.	101	111	106	105
DIFUSER TYPE	HS	HS	VHS	HS
DIFUSER SIZE	250×250	250×250	150×150	200×200
AIR FLOW	RA: 400CMH	SA: 400CMH	OA: 100CMH	EA: 300CMH
BOX SIZE	450×450×350H	450×450×350H	350×350×300H	400×400×300H
Q'ty	1	1	1	2
REMARKS			C/W FILTER	

INSIDE BOX SHOULD BE INSULATED WITH MUFFLING MATERIAL 25mm THICKNESS.

INSTALLATION DETAIL FOR PROPELLER FAN NO SCALE



DETAIL FOR SOAKED PIT NO SCALE

REINFORCE BAR : 9Φ~200 DISTANCE

U/G : UNDER GROUND
A/C : ABOVE CEILING
D/G : DOOR LOUVER

REFRIGERANT PIPE LIST(LIAUID/SUCTION PIPE)
Ⓐ: 6.4Φ/12.7Φ
Ⓑ: 9.5Φ/15.9Φ

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

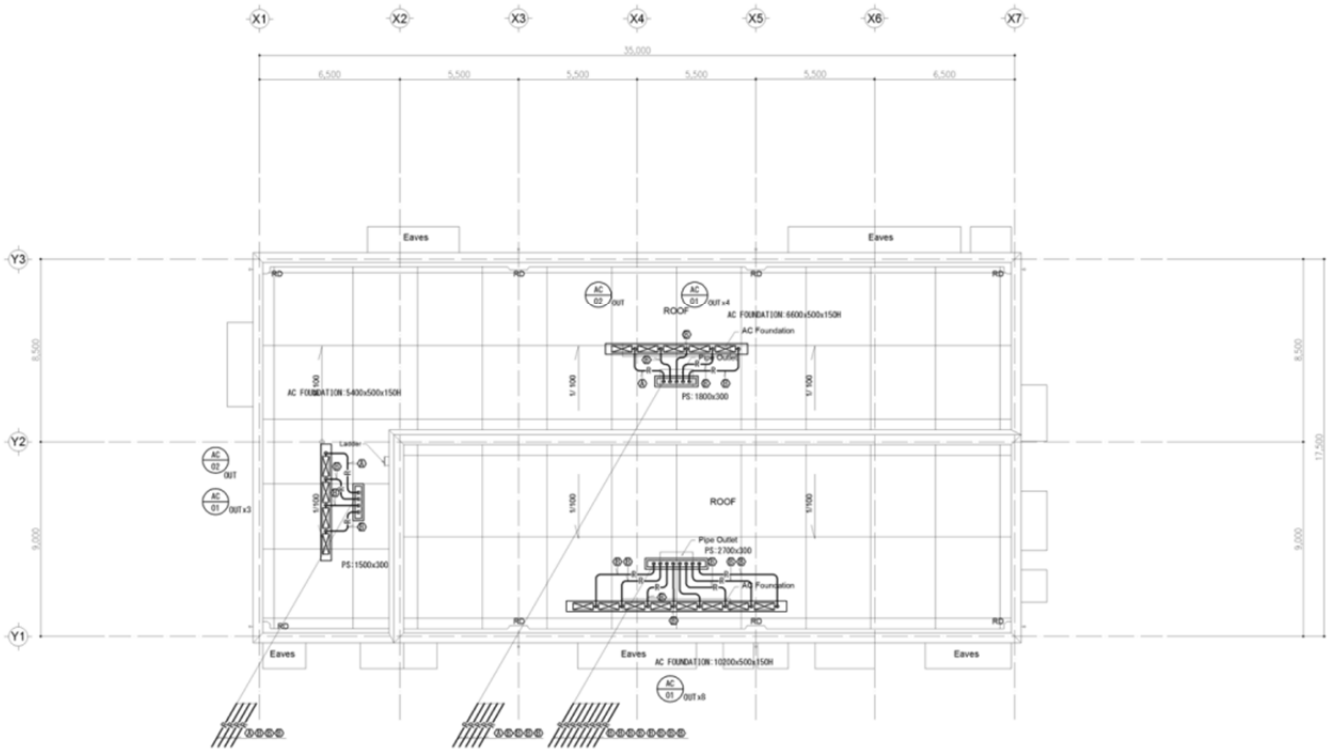
GENERAL NOTE

SCALE	1/200
DATE	Aug. 2014

DWG. TITLE: GROUND FLOOR PLAN FOR VAC SYSTEM

DWG. NO.: M-02

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.



ROOF PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE: 1/200 DATE: Aug. 2014	DWG. TITLE: ROOF PLAN FOR VAC SYSTEM	DWG. NO: M-03
				Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

LEGEND

SYMBOL	DESCRIPTION	MATERIAL
R	REMOTE CONTROL FOR FAN	

FAN

SERIAL NO.	TYPE	FLOW RATE (CMH)	ROTATION (RPM)	POWER (50 Hz) W	φ	V	Q'TY	LOCATION	REMARKS
CF-01	CEILING FAN	4000	150	28	1	220	1	SECURITY ROOM	C/W REMOTE CONTROL SWITCH

VENTILATION SYSTEM GUARD HOUSE
1/100 A1
1/200 A3

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

SCALE 1/200
DATE Aug. 2014

DWG. TITLE VAC SYSTEM FOR GUARD HOUSE

DWG. NO. M-04

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.

SYMBOL LIST FOR ELECTRICAL WORK

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
1) BOARD, PANEL AND OTHER					
	MOTOR CONTROL PANEL		FL18Wx1 MIRROR LIGHT		OUTLET BOX
	LIGHTING PANEL		PLC18Wx1 DOWN LIGHT	wp	OUTLET BOX (WETHER PROOF TYPE)
	LIGHTING AND POWER PANEL		PLC13Wx1 BRACKET LIGHT		PULL BOX
	PANEL (BY OTHER WORK)		FL10W x1 EXIT LIGHT C/W BATT. BACK UP 2 Hr.	wp	PULL BOX WATER PROOF
			VENTILATION FAN (CEILING TYPE) (BY MECH. WORK)	n	CIRCUIT NO. 1Ø 220V FOR LIGHTING,SOCKET OUTLET
FS	FLOAT ELECTRODE		VENTILATION FAN (AXIAL TYPE) (BY MECH. WORK)	n	CIRCUIT NO. 3Ø 380V
LF	ELECTRODE		SINGLE POLE SWITCH AC 250V 1P 10A		
		3	3-WAY SWITCH AC 250V 10A		
		4	4-WAY SWITCH AC 250V 10A		
2) SOCKET OUTLET			SINGLE POLE SWITCH W/ILLUMINATED LAMP OR GLOW LAMP	NOTE :	UNLESS OTHERWISE INDICATED IN THE DRAWING FIXING
2E	SOCKET OUTLET 250V 2P+E 13A 2GANGS WALL MOUNTED TYPE		1P 4A AC 250V		HEIGHT OF WALL SWITCH AND OUTLETS SHALL BE AS
WP	SOCKET OUTLET 250V 2P+E 13A 1GANG				FOLLOWS :-
	WALL MOUNTED WATER FROOF TYPE				
	SOCKET OUTLET 250V 2P+E 13A 2GANGS POP UP TYPE			ITEM	DESCRIPTION OF LEVEL / FIXING HEIGHT
				PANEL	TOP LEVEL OF PANEL TO FINISHED FLOOR / +1900
	SOCKET OUTLET 1GANG 2P+E 250V 15A LOCKING TYPE			TERMINAL BOARD	BOTTOM OF BOARD TO FINISHED FLOOR LEVEL / + 600
	WALL MOUNTED TYPE	4) FIRE ALARM SYSTEM			
20A	SOCKET OUTLET 1GANG 2P+E 250V 20A LOCKING TYPE		FIRE ALARM CONTROL PANEL	LIGHTING	
	WALL MOUNTED TYPE	S	PHOTOELECTRIC SPOT TYPE SMOKE DETECTOR	WALL BRACKET	CENTER OF FIXTURE / +2200
20A WP	SOCKET OUTLET 1GANG 2P+E 250V 20A LOCKING TYPE		2 CLASS EXPOSED TYPE	(GENERAL)	TO FINISHED FLOOR LEVEL
	WALL MOUNTED WATER PROOF TYPE		FIXED TEMPERATURE SPOT TYPE HEAT DETECTOR	WALL BRACKET	CENTER OF FIXTURE / +2500
			1 CLASS WATERPROOF 70 DEG.	(STAIR CASE)	TO FINISHED FLOOR LEVEL
			RATE OF RISE SPOT TYPE HEAT DETECTOR	WALL (MIRROR)	FROM TOP OF MIRROR / + 150
			2 CLASS		
		Ω	END-OF-LINE RESISTOR::10KΩ	SWITCH	CENTER OF BOX TO FLOOR LEVEL / +1300
		B	LAMP-BELL-MANUAL FIRE ALARM BOX	SOCKET	CENTER OF BOX TO FLOOR LEVEL / + 300
		5) WIRING		EXIT LIGHT	CENTER OF BOX TO TOP OF DOOR / + 150
			WIRE OR CABLE AND CONDUIT, CONCEALED IN CEILING,		
			EXPOSED ON CEILING OR EMBEDED IN CEILING SLAB		
			DITTO EMBEDED IN FLOOR SLAB		
3) LIGHTING FIXTURE AND FAN			DITTO EXPOSED ON SLAB		
	FL36Wx2 V-SHAPE TYPE		DITTO UNDER GROUND		
	FL36Wx1 V-SHAPE TYPE	C	SPARE CONDUIT		
	FL36Wx2 REFLECTOR TYPE		HOME RUN TO DISTRIBUTION BOARD		
	FL36Wx1 REFLECTOR TYPE		WIRING UP OR DOWN		
	FL36Wx2 RECESS MOUNTED TYPE W/AL LOUVER		WIRING THROUGH		
	FL36Wx2 RECESS MOUNTED OPEN TYPE				
	FL36Wx1 RECESS MOUNTED OPEN TYPE				

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

SCALE: NONE
DATE: Aug. 2014

DWG. TITLE: SYMBOL LIST FOR ELECTRICAL WORK
DWG. NO: E-01

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.

DISTRIBUTION BOARD LIST

LEGEND:

1. 1L-1
   - SEQUENCE NUMBER
   - TYPE OF PANEL
   - FLOOR

L- LIGHTING DISTRIBUTION PANEL
LP- LIGHTING AND POWER PANEL
C- RECEPTACLE PANEL
P- POWER PANEL

2. MCCB = MOLDED CASE CIRCUIT BREAKER
3. MCB = MINIATURE CIRCUIT BREAKER
4. ELB = EARTH LEAKAGE CIRCUIT BREAKER
5. MC = MAGNETIC CONTACTOR
6. RR = REMOTE CONTROL RELAY
7. SPD = SURGE PROTECTION DEVICE
8. TYPE OF PANEL ENCLOSURE
   (W) = WALL MOUNTED TYPE
   (S) = SELF-STANDING TYPE
   (F) = FLASH MOUNTED TYPE

1LP-1 Enclosure : (W) or (S) (Normal Line)

AC 3Ø4W 380/220V 50Hz

8 FUSE ×3

SPD CLASS 2 ×3

CKT. NO.	TYPE	POLE	AF	AT	MC or RR	RN	SN	TN	3ø	LOAD NAME	REMARKS
Main	MCCB	3P+N	225	225	–					MAIN BLDG. (DISTRIBUTION PANEL Rm)	
Ⓐ	ELB	2P	50	15	–	100				Lighting OUTDOOR	
Ⓑ	ELB	2P	50	15	–		1,000			Lighting,EF TOILET(M),(F),OFFICE Rm	
Ⓒ	ELB	2P	50	15	–			1,000		Lighting,EF CORRIDOR,KITCHEN,PLC RTU,STORE Rm	
Ⓓ	ELB	2P	50	15	–	2,300				Lighting,EF CONTROL Rm	
Ⓔ	MCB	2P	50	15	–		2,300			Lighting,EF CONTROL Rm	
Ⓕ	MCB	2P	50	15	–			1,900		Lighting,EF CUBICLE Rm	
Ⓖ	MCB	2P	50	15	–	900				Lighting,EF BATTERY Rm,DISTRIBUTION PANEL Rm	
Ⓗ	MCB	2P	50	15	–		100			Lighting OUTDOOR	
Ⓘ	MCB	2P	50	15	–			140		Emergency light	
Ⓙ	MCB	2P	50	15	–	60				EXIT Lighting	
○	MCB	2P	50	15	–		–			Spare	
○	MCB	2P	50	15	–			–		Spare	
①	MCB	2P	50	15	–	300				S.O. OFFICE Rm	
②	ELB	2P	50	15	–		300			S.O. CORRIDOR,KITCHEN	
③	MCB	2P	50	15	–			300		S.O. PLC RTU,STORE Rm	
④	MCB	2P	50	15	–	300				S.O. CONTROL Rm	
⑤	MCB	2P	50	15	–		400			S.O. CONTROL Rm	
⑥	MCB	2P	50	15	–			100		S.O. CONTROL Rm	
⑦	MCB	2P	50	15	–	400				S.O. BATTERY Rm	
⑧	MCB	2P	50	15	–		300			S.O. DISTRIBUTION PANEL Rm	
⑨	MCB	2P	50	15	–			300		S.O. CUBICLE Rm	
⑩	MCB	2P	50	15	–	300				S.O. CUBICLE Rm	
⑪	ELB	2P	50	15	–		400			S.O. TOILET(F)	
⑫	ELB	2P	50	15	–			400		S.O. TOILET(M)	
⑬	MCB	2P	50	15	–	1,200				S.O. OFFICE Rm	
⑭	MCB	2P	50	15	–		100			FIRE ALARM CONTROL PANEL	
⑮	ELB	2P	50	15	–			600		S.O. KITCHEN	
⑯	ELB	2P	50	15	–	600				S.O. KITCHEN	
⑰	ELB	2P	50	15	–		600			S.O. KITCHEN	
○	ELB	2P	50	15	–			–		Spare	
○	ELB	2P	50	15	–	–				Spare	
△1	ELB	2P	50	15	–				1,500	PUMP	
Total (LTG)	9.800 KVA					(3,360)	(3,400)	(3,040)		Lighting,EF	
Total (S.O.)	6.900 KVA					(3,100)	(2,100)	(1,700)		SOCKET	
Total (CP)	1.500 KVA								(1,500)	PUMP	
Total	18.200 KVA					(6,460)	(5,500)	(4,740)	(1,500)		

1L-2 Enclosure : (W) (Normal Line)

AC 1Ø3W 220V 50Hz

8 FUSE ×3

SPD CLASS 2 ×3

CKT. NO.	TYPE	POLE	AF	AT	MC or RR	RN	SN	TN	3ø	LOAD NAME	REMARKS
Main	MCCB	3P+N	50	□50	–					GUARD HOUSE (SECURITY Rm.)	
Ⓐ	ELB	2P	50	15	–	510				Lighting,EF SECURITY Rm	
○	ELB	2P	50	15	–		–			Spare	
①	MCB	2P	50	15	–		400			S.O. SECURITY Rm	
○	ELB	2P	50	15	–	–				Spare	
Total (LTG)	0.510 KVA					(510)				Lighting,EF	
Total (S.O.)	0.400 KVA						(400)			SOCKET	
Total	0.910 KVA					(510)	(400)				

RL-1 Enclosure : (S) (Normal Line)

AC 3Ø4W 380/220V 50Hz

8 FUSE ×3

SPD CLASS 2 ×3

CKT. NO.	TYPE	POLE	AF	AT	MC or RR	RN	SN	TN	3ø	LOAD NAME	REMARKS
Main	MCCB	3P+N	225	150	–					MAIN BLDG. (RF)	
△1	ELB	2P	50	15	–	3,000				PAC-1 CUBICLE Rm	
△2	ELB	2P	50	15	–		3,000			PAC-1 CUBICLE Rm	
△3	ELB	2P	50	15	–			3,000		PAC-1 CUBICLE Rm	
△4	ELB	2P	50	15	–	3,000				PAC-1 CUBICLE Rm	
△5	ELB	2P	50	15	–		3,000			PAC-1 CUBICLE Rm	
△6	ELB	2P	50	15	–			3,000		PAC-1 CUBICLE Rm	
△7	ELB	2P	50	15	–	3,000				PAC-1 CUBICLE Rm	
△8	ELB	2P	50	15	–		3,000			PAC-1 CUBICLE Rm	
△	ELB	2P	50	15	–			–		Spare	
Total (AC)	24.000 KVA					(9,000)	(9,000)	(6,000)		AC	
Total	24.000 KVA					(9,000)	(9,000)	(6,000)			

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

SCALE: NONE
DATE: Aug. 2014

DWG. TITLE: LOAD TABLE OF DISTRIBUTION BOARD(1)

DWG. NO.: E-02

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.

DISTRIBUTION BOARD LIST

LEGEND:

1. 1L-1
   - 1 = SEQUENCE NUMBER
   - L = TYPE OF PANEL
   - 1 = FLOOR

L- LIGHTING DISTRIBUTION PANEL
LP- LIGHTING AND POWER PANEL
C- RECEPTACLE PANEL
P- POWER PANEL

2. MCCB = MOLDED CASE CIRCUIT BREAKER
3. MCB = MINIATURE CIRCUIT BREAKER
4. ELB = EARTH LEAKAGE CIRCUIT BREAKER
5. MC = MAGNETIC CONTACTOR
6. RR = REMOTE CONTROL RELAY
7. SPD = SURGE PROTECTION DEVICE
8. TYPE OF PANEL ENCLOSURE
   (W) = WALL MOUNTED TYPE
   (S) = SELF-STANDING TYPE
   (F) = FLASH MOUNTED TYPE

RL-2

Enclosure : (S)
(Normal Line)

AC 3Ø4W
380/220V
50Hz

SPD
CLASS 2
×3

CKT. NO.	BRANCH BREAKER TYPE	POLE	AF	AT	MC or RR	LOAD CAPACITY (VA) RN	SN	TN	3ø	LOAD NAME	REMARKS
Main	MCCB	3P+N	100	100	–					MAIN BLDG. (RF)	
1	ELB	2P	50	15	–	3,000				PAC-1 DISTRIBUTION PANEL Rm	
2	ELB	2P	50	15	–		3,000			PAC-1 DISTRIBUTION PANEL Rm	
3	ELB	2P	50	15	–			3,000		PAC-1 DISTRIBUTION PANEL Rm	
4	ELB	2P	50	15	–	1,900				PAC-2 OFFICE Rm	
△	ELB	2P	50	15	–		–			Spare	
Total (AC)	10.900 KVA					(4,900)	(3,000)	(3,000)		AC	
Total	10.900 KVA					(4,900)	(3,000)	(3,000)			

RL-3

Enclosure : (S)
(Normal Line)

AC 3Ø4W
380/220V
50Hz

SPD
CLASS 2
×3

CKT. NO.	BRANCH BREAKER TYPE	POLE	AF	AT	MC or RR	LOAD CAPACITY (VA) RN	SN	TN	3ø	LOAD NAME	REMARKS
Main	MCCB	3P+N	100	100	–					MAIN BLDG. (RF)	
1	ELB	2P	50	15	–	1,900				PAC-2 OFFICE Rm	
2	ELB	2P	50	15	–		3,000			PAC-1 SUPERVISE AND CONTROL Rm	
3	ELB	2P	50	15	–			3,000		PAC-1 SUPERVISE AND CONTROL Rm	
4	ELB	2P	50	15	–	3,000				PAC-1 SUPERVISE AND CONTROL Rm	
5	ELB	2P	50	15	–		3,000			PAC-1 SUPERVISE AND CONTROL Rm	
△	ELB	2P	50	15	–				–	Spare	
Total (AC)	13.900 KVA					(4,900)	(6,000)	(3,000)		AC	
Total	13.900 KVA					(4,900)	(6,000)	(3,000)			

OL-1

Enclosure : (W) or (S)
(Normal Line)

AC 1Ø2W
220V
50Hz

SPD
CLASS 2
×2

CKT. NO.	BRANCH BREAKER TYPE	POLE	AF	AT	MC or RR	LOAD CAPACITY (VA) RN	SN	TN	3ø	LOAD NAME		REMARKS
Main	MCCB	2P	225	200	–							
A	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
B	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
C	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
D	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
E	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
F	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
G	ELB	2P	50	30	MC	2,500				Outdoor Lighting		PHOTO SW.+24h TIMER or MANUAL
H	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
I	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
J	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
K	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
L	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
M	ELB	2P	50	30	MC	2,400				Outdoor Lighting	SPOT LIGHT	MANUAL SW.
○	ELB	2P	50	30	–	–				Spare		
Total (LTG)	31.900 KVA					(31,900)				Outdoor Lighting		
Total	31.900 KVA											

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

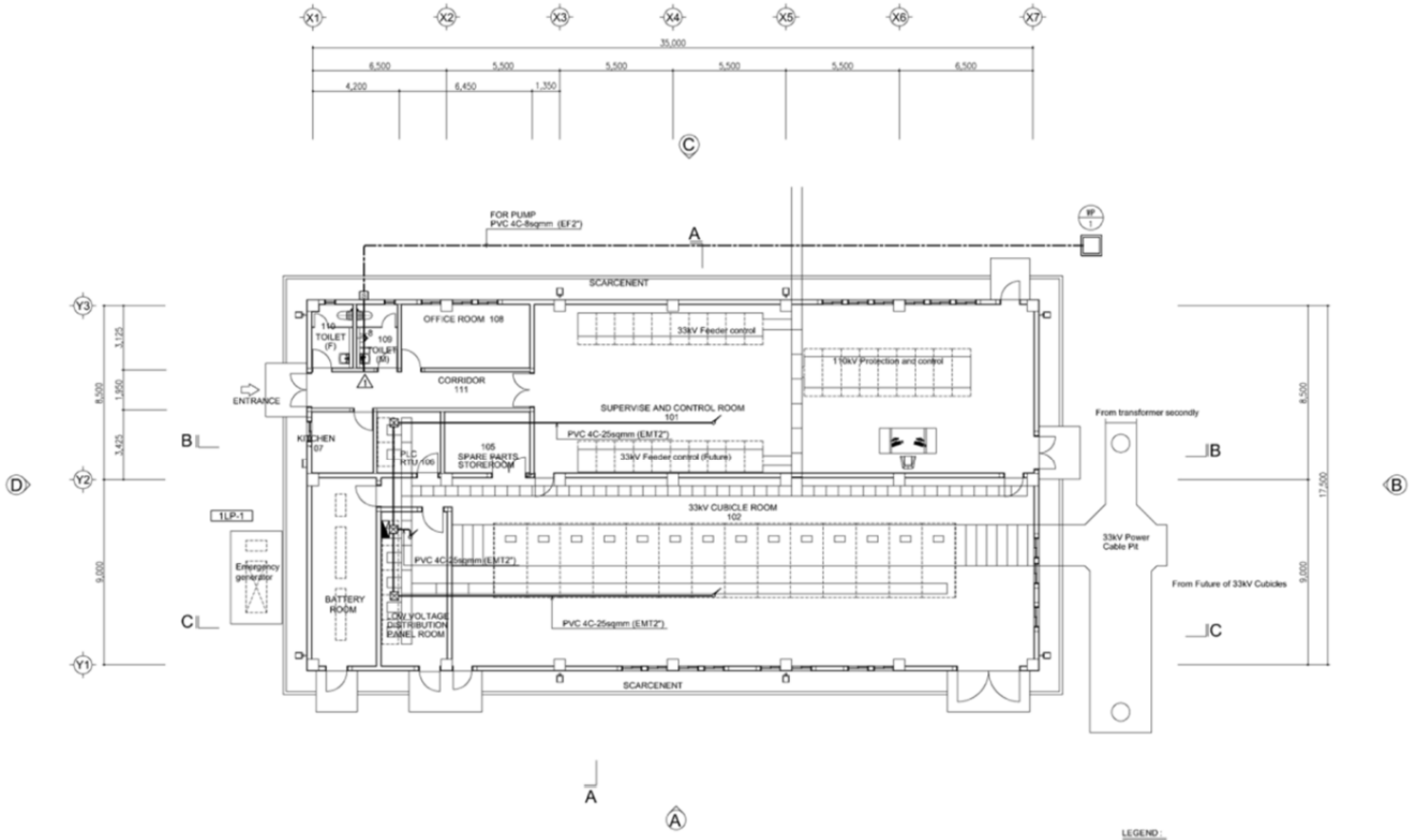
REVISIONS

SCALE NONE
DATE Aug. 2014

DWG. TITLE LOAD TABLE OF DISTRIBUTION BOARD(2)

DWG. NO. E-03

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.



GROUND FLOOR PLAN

LEGEND :

POWER WIRING SYSTEM

SYMBOL	DESCRIPTION
	: ISOLATOR BOX (WATER PROOF TYPE) MCB2P 15A
	: PULL BOX
	: PVC 4C-5.5sqmm (EMT1")
	: PVC 4C-8sqmm (PVC1 1/2")

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

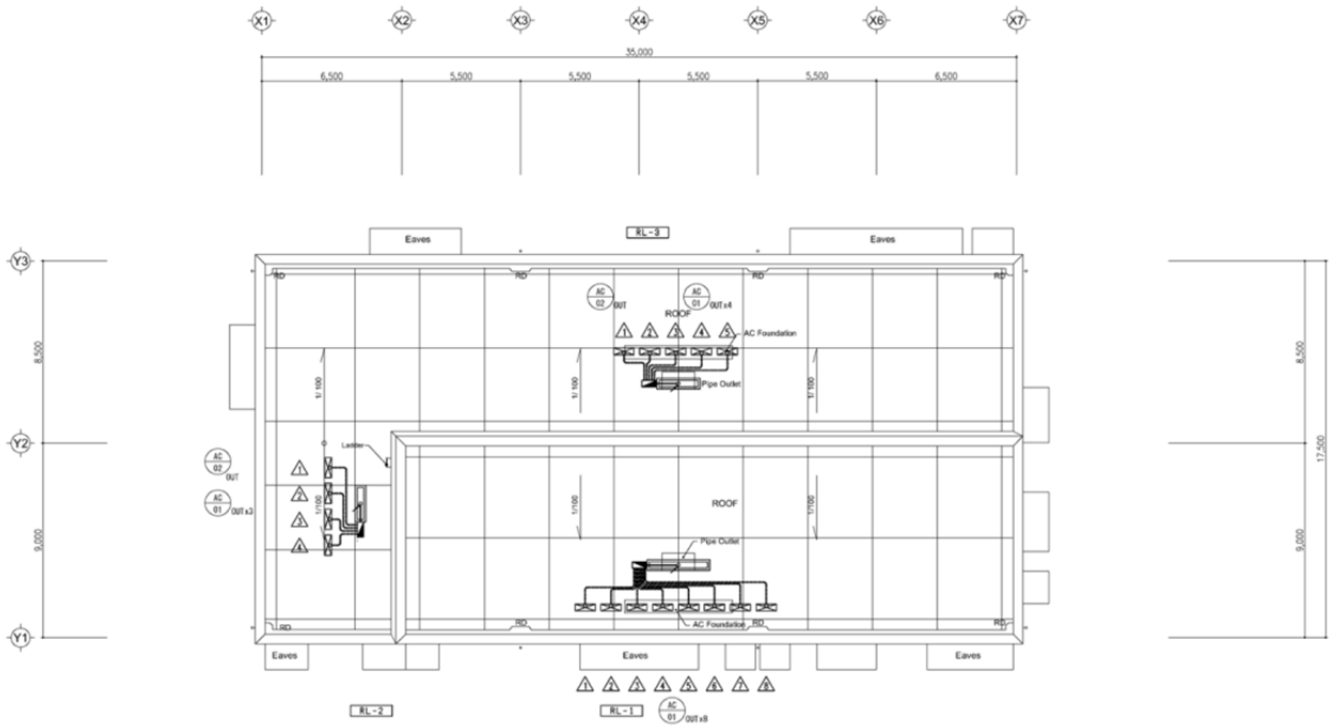
REVISIONS

SCALE 1/200
DATE Aug. 2014

DWG. TITLE
GROUND FLOOR PLAN FOR POWER WIRING SYSTEM

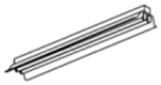
DWG. NO.
E-04

Oriental Consultants Global Co.,Ltd.
Tokyo Electric Power Services Co.,Ltd.



ROOF PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	REVISIONS	SCALE: 1/200	DWG. TITLE: ROOF PLAN FOR POWER WIRING SYSTEM	DWG. NO.: E-05
			DATE: Aug. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

A	RECESS MOUNTED TYPE (WIHT AL LOUVER)			B	RECESS MOUNTED OPEN TYPE			C	REFLECTOR TYPE (WITH OR W/O PENDANT)			D	V-SHARPE TYPE			E	DOWN LIGHT		
																			
A362	FL 36W x 2	SYMBOL		B362	FL 36W x 2	SYMBOL		C362	FL 36W x 2	SYMBOL		D362	FL 36W x 2	SYMBOL		E181	FDL 18W x 1	SYMBOL	
F	MIRROR LIGHT			G	BRACKET LIGHT (WATER PROOF TYPE)			X	EXIT LIGHT			Ea	EMERGENCY LIGHT			Eb	EMERGENCY LIGHT		
																			
F181	FL 18W x 1	SYMBOL		G131	PLC 13Wx1	SYMBOL		X1	FL 10W x 1 c/w BATT. 30MIN	SYMBOL		Ea301	HALOGEN LAMP 30W×1 c/w BATT. 30MIN	SYMBOL		Eb301	HALOGEN LAMP 30W×1 c/w BATT. 30MIN	SYMBOL	

NOTE:

1. THE STARTING METHOD OF FLUORESCENT FIXTURES SHALL BE AS FOLLOWS:
   FL36W – GLOW START / HIGH POWER FACTOR
   FL18W, FL10W, PCL18W & PCL13W – GLOW START / LOW POWER FACTOR

PROJECT TITLE
PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

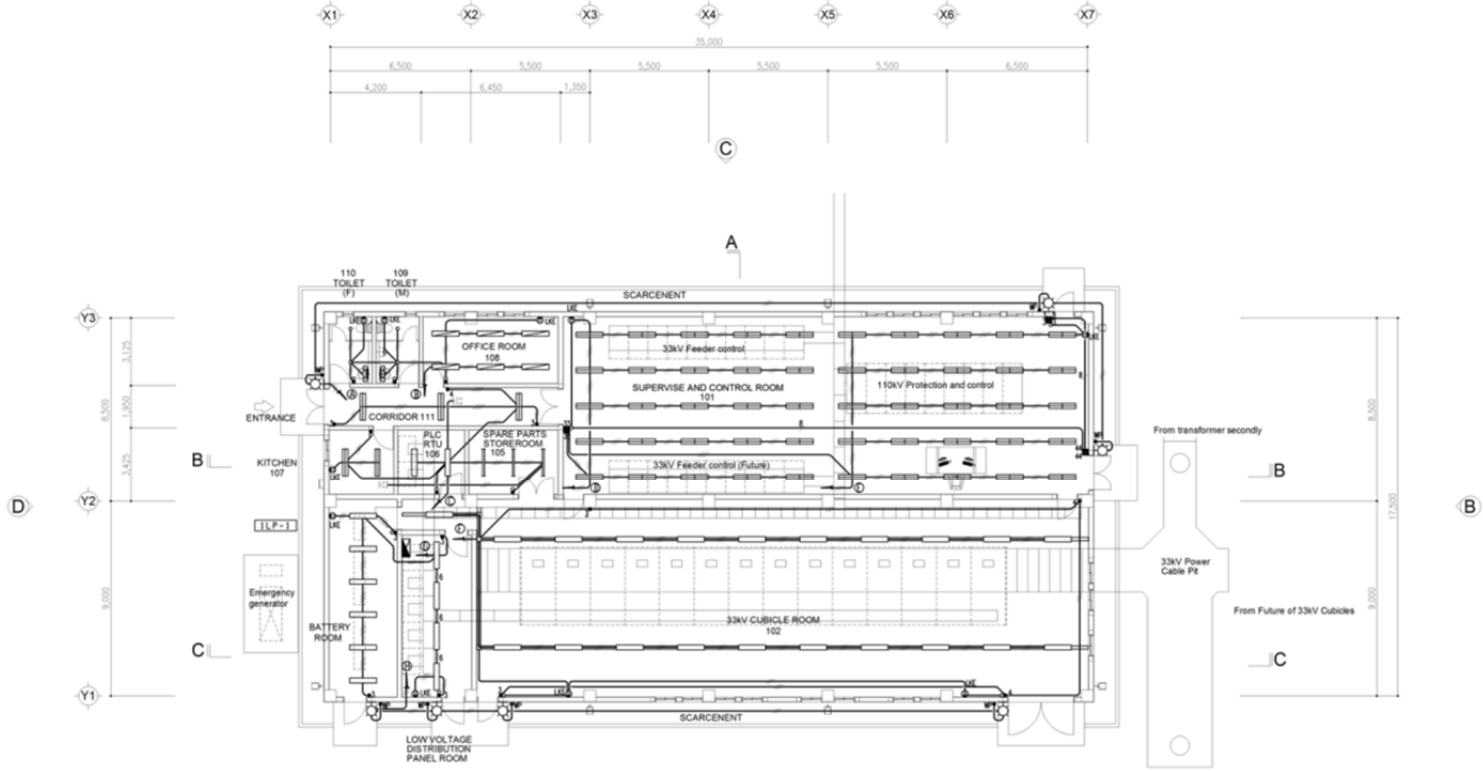
GENERAL NOTE

NO. | DATE | DESCRIPTIONS | BY | APPD
REVISIONS

SCALE 1/200
DATE Aug. 2014
DRAWN BY
CHECKED BY

DWG. TITLE: LIGHTING FIXTURE SCHEDULE
DWG. NO. E-06

Oriental Consultants Global Co.,Ltd. | Tokyo Electric Power Services Co.,Ltd.



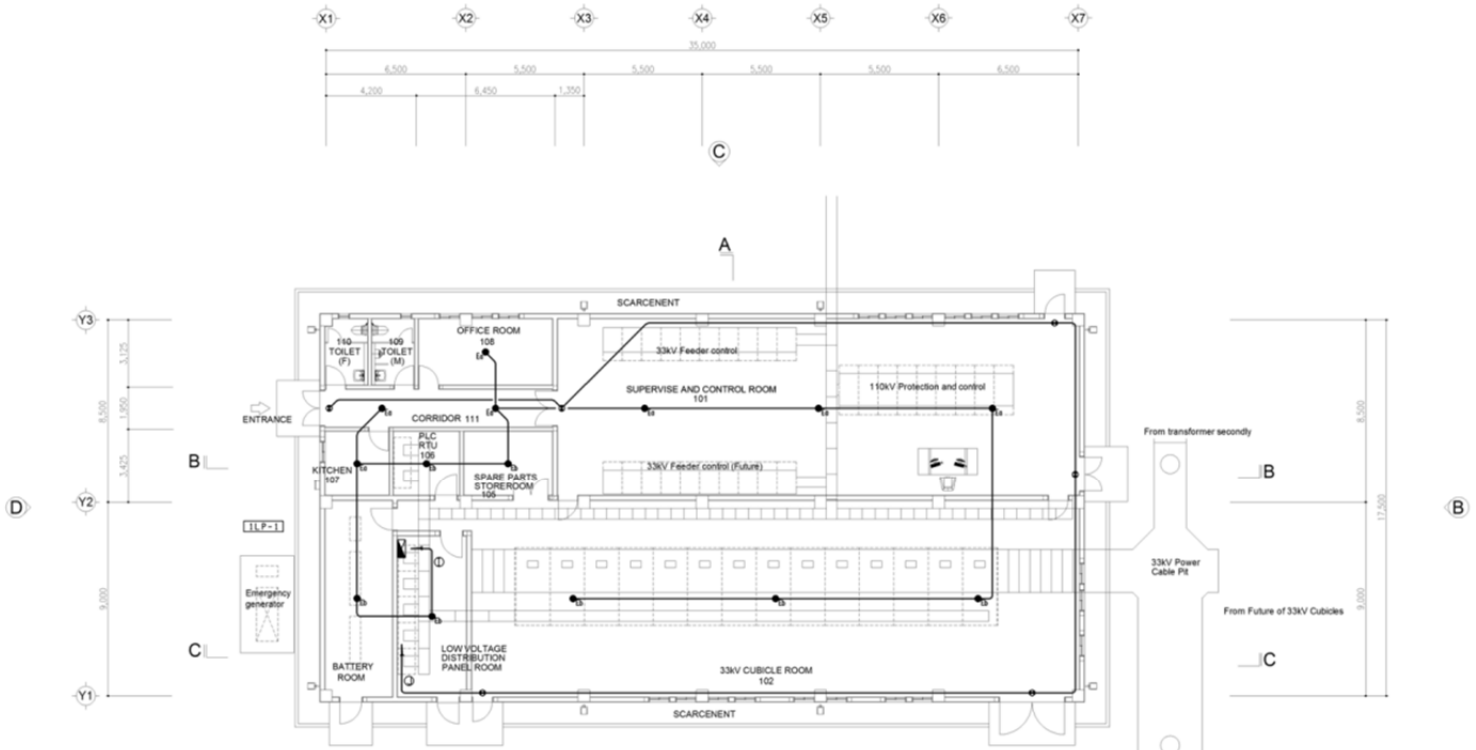
LEGEND :

LIGHTING SYSTEM

SYMBOL	DESCRIPTION
	: DISTRIBUTION BOARD
	: FL36Wx2 V-SHAPE TYPE
	: FL36Wx2 REFLECTOR TYPE
	: FL36Wx2 RECESS MOUNTED TYPE W/AL. LOUVER
	: FL36Wx2 RECESS MOUNTED OPEN TYPE
	: FL20Wx1 MIRROR LIGHT
	: PLC13Wx1 DOWN LIGHT
	: IL60Wx1 BRACKET LIGHT
•	: SINGLE POLE SWITCH AC 250V 1P 10A
•3	: 3-WAY SWITCH AC 250V 10A
•4	: 4-WAY SWITCH AC 250V 10A
•VP	: SINGLE POLE SWITCH AC 250V 1P 10A(WATER PROOF TYPE)
○	: SINGLE POLE SWITCH W/ILLUMINATED LAMP OR GLOW LAMP 1P 4A AC 250V
Φ_{LKE}	: SOCKET OUTLET 250V 2P+E 13A 1GANGS (WALL MOUNTED LOCK TYPE)
	: PVC 2 x 2.5 sqmm (PVC3/4")
3	: PVC 3 x 2.5 sqmm (PVC3/4")
4	: PVC 4 x 2.5 sqmm (PVC1")
6	: PVC 6 x 2.5 sqmm (PVC1 1/4")
8	: PVC 8 x 2.5 sqmm (PVC1 1/4")

GROUND FLOOR PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	REVISIONS	SCALE: 1/200 DATE: Aug. 2014	DWG. TITLE: GROUND FLOOR PLAN FOR LIGHTING SYSTEM	DWG. NO.: E-07
				Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



LEGEND :

EMERGENCY LIGHTING SYSTEM

SYMBOL	DESCRIPTION
	: DISTRIBUTION BOARD
	: EMERGENCY LIGHT
	: EMERGENCY LIGHT
	: FL10W x1 EXIT LIGHT C/W BATT. BACK UP 2 Hr.
	: PVC 2 x 2.5 sqmm (PVC3/4")

GROUND FLOOR PLAN

PROJECT TITLE

PREPARATORY SURVEY ON
THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE
IN NACALA CORRIDOR
IN THE REPUBLIC OF MOZAMBIQUE

GENERAL NOTE

REVISIONS

SCALE 1/200

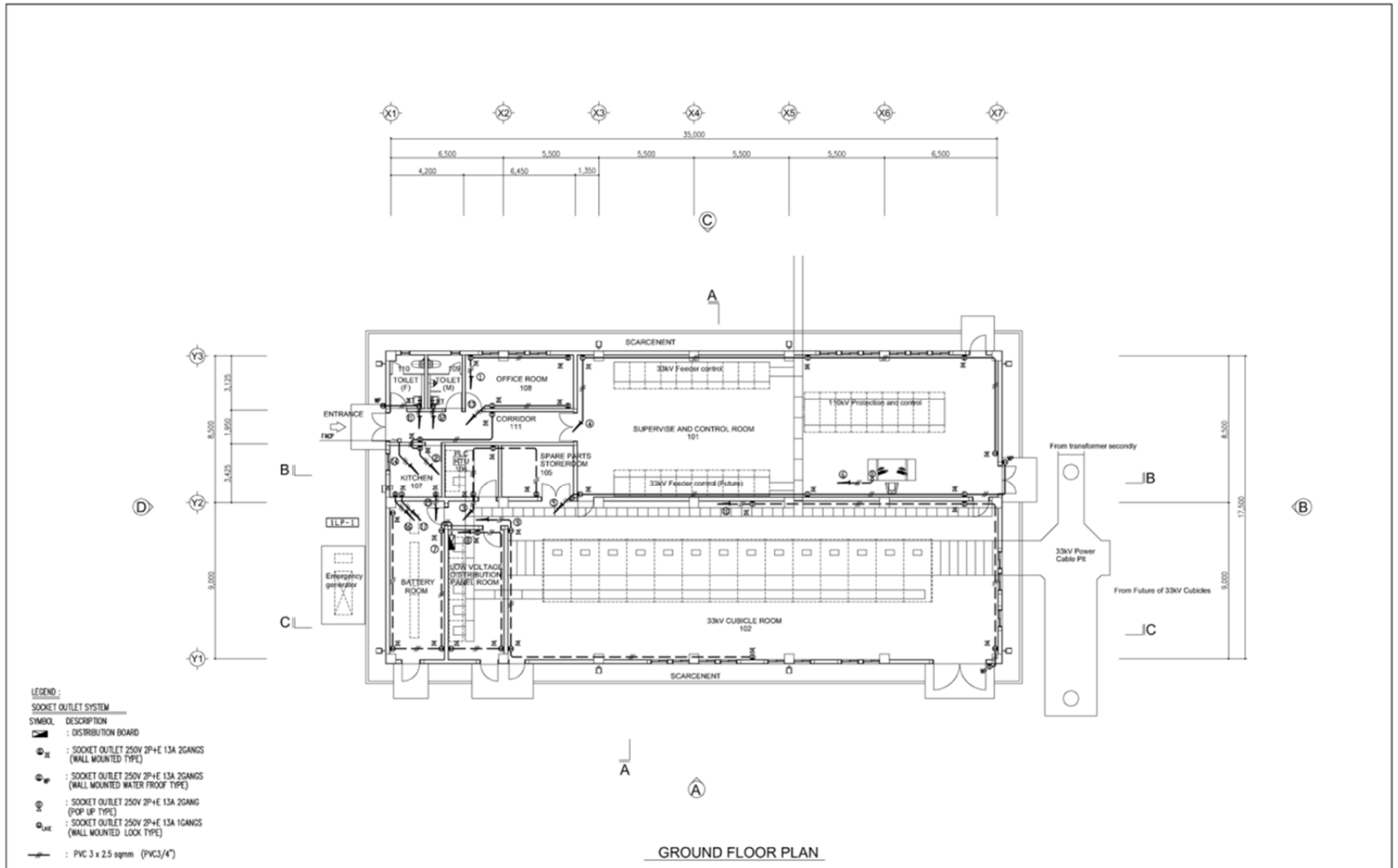
DATE Aug. 2014

DWG. TITLE GROUND FLOOR PLAN FOR EMERGENCY LIGHTING SYSTEM

DWG. NO. E-08

Oriental Consultants Global Co.,Ltd.

Tokyo Electric Power Services Co.,Ltd.



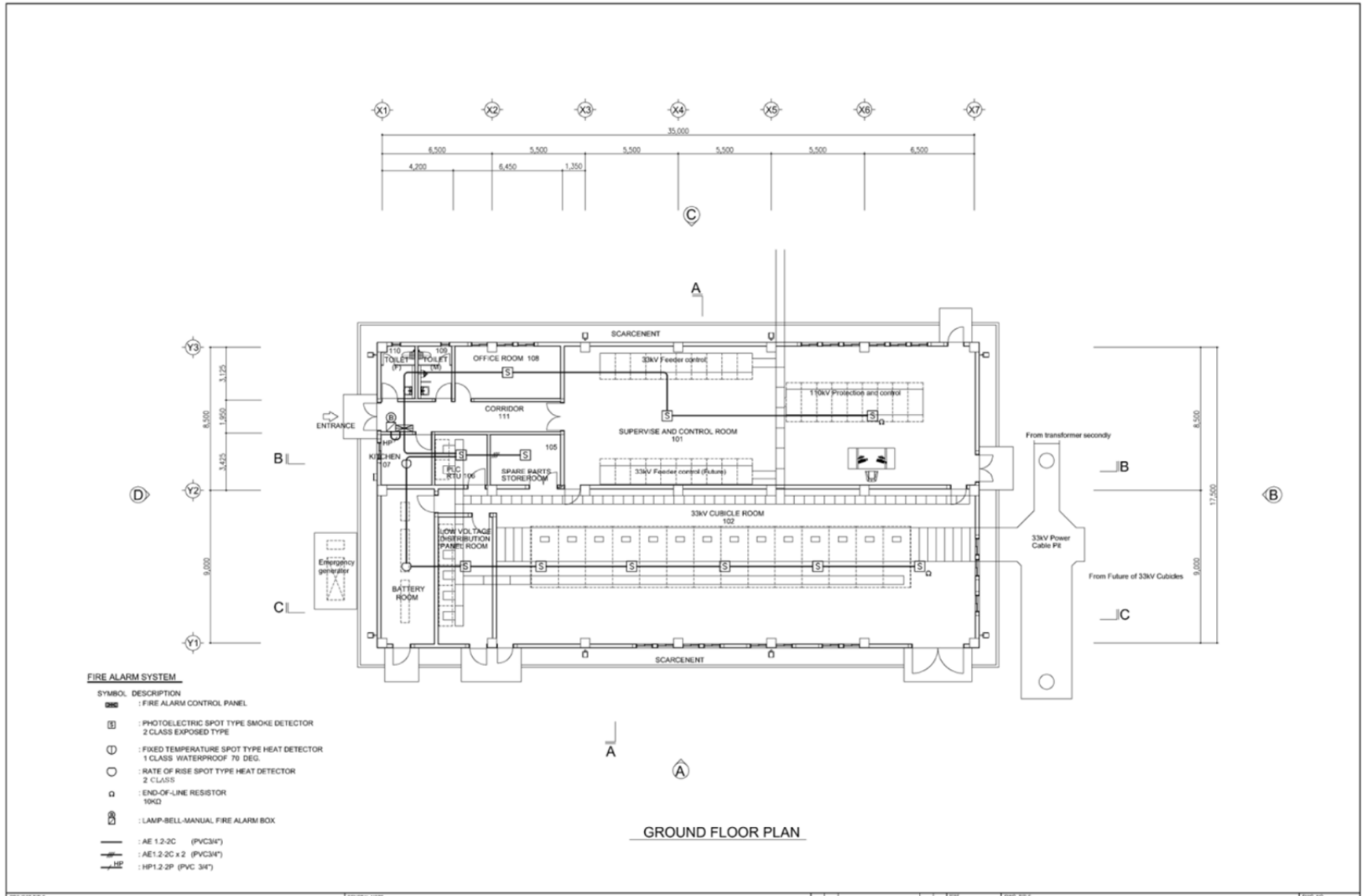
LEGEND :

SOCKET OUTLET SYSTEM

SYMBOL	DESCRIPTION
	: DISTRIBUTION BOARD
	: SOCKET OUTLET 250V 2P+E 13A 2GANGS (WALL MOUNTED TYPE)
	: SOCKET OUTLET 250V 2P+E 13A 2GANGS (WALL MOUNTED WATER FROOF TYPE)
	: SOCKET OUTLET 250V 2P+E 13A 2GANG (POP UP TYPE)
	: SOCKET OUTLET 250V 2P+E 13A 1GANGS (WALL MOUNTED LOCK TYPE)
	: PVC 3 x 2.5 sqmm (PVC3/4")

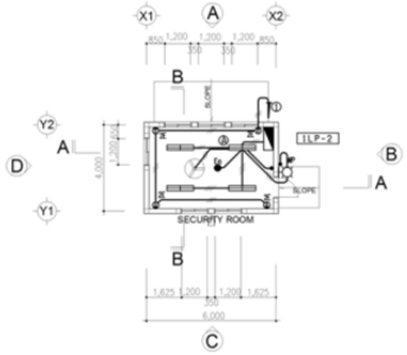
GROUND FLOOR PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	REVISIONS	SCALE: 1/200	DWG. TITLE: GROUND FLOOR PLAN FOR SOCKET OUTLET SYSTEM	DWG. NO.: E-09
			DATE: Aug. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.

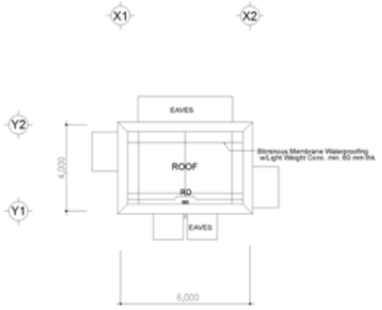


GROUND FLOOR PLAN

PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE		SCALE 1/200	DWG. TITLE: GROUND FLOOR PLAN FOR FIRE ALARM SYSTEM	DWG. NO. E-10
			DATE Aug. 2014	Oriental Consultants Global Co.,Ltd.	Tokyo Electric Power Services Co.,Ltd.



GROUND FLOOR PLAN

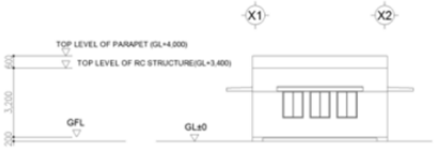


ROOF PLAN

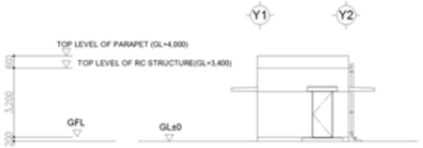
LEGEND :

LIGHTING & SOCKET OUTLET SYSTEM

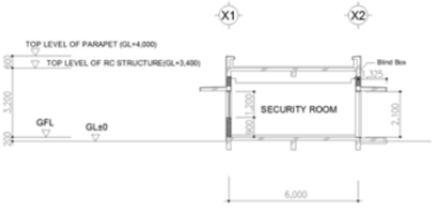
SYMBOL	DESCRIPTION
	: DISTRIBUTION BOARD
	: FL36Wx2 RECESS MOUNTED OPEN TYPE
	: IL60Wx1 BRACKET LIGHT
	: EMERGENCY LIGHT
	: SINGLE POLE SWITCH AC 250V 1P 10A
	: SINGLE POLE SWITCH AC 250V 1P 10A(WATER PROOF TYPE)
	: SOCKET OUTLET 250V 2P+E 13A 2GANGS (WALL MOUNTED TYPE)
	: CEILING FAN (BY MECH. WORK)
	: PVC 3 x 2.5 sqmm (PVC3/4")
	: PVC 2 x 2.5 sqmm (PVC3/4")
	: PVC 4C-5.5sqmm (PVC2")



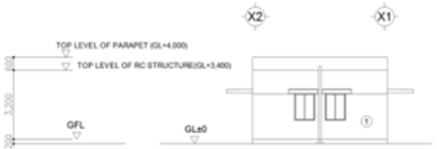
A ELEVATION



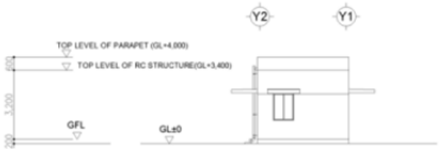
B ELEVATION



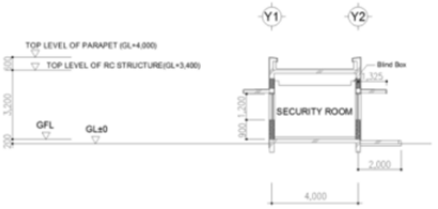
A - A SECTION



C ELEVATION

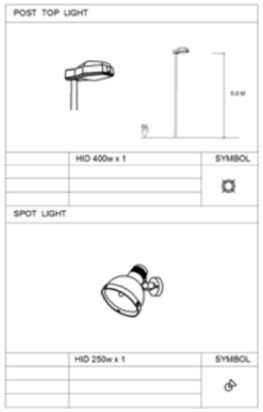


D ELEVATION



B - B SECTION

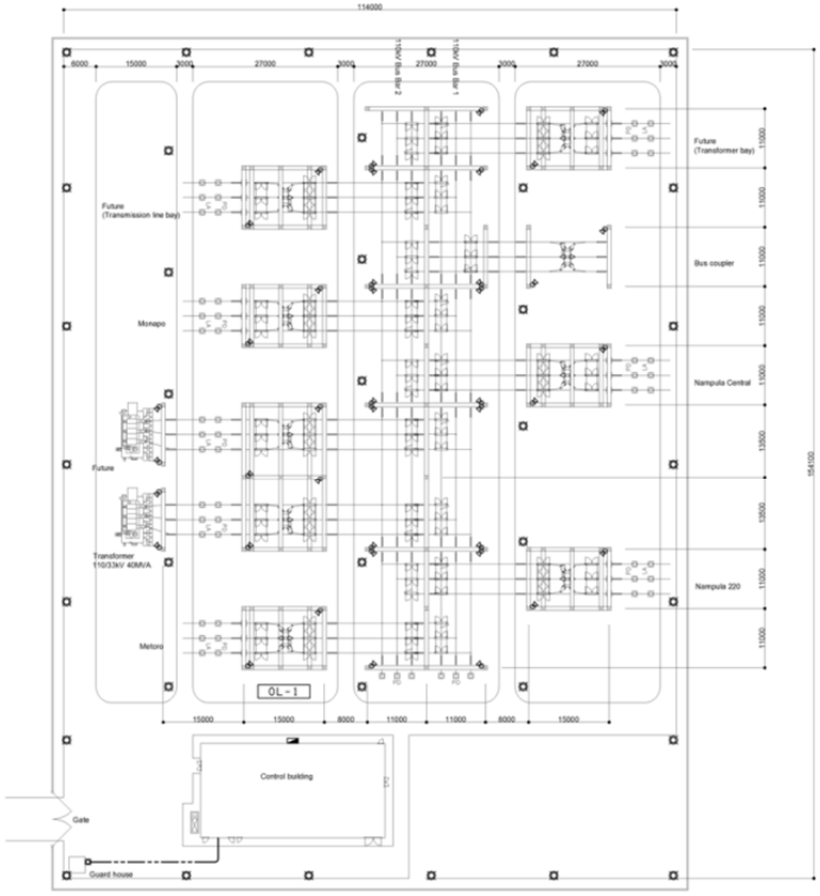
PROJECT TITLE: PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	GENERAL NOTE	SCALE: 1/200 DATE: Aug. 2014	DWG. TITLE: GUARD HOUSE PLAN ELECTRICAL SYSTEM
		Oriental Consultants Global Co.,Ltd. / Tokyo Electric Power Services Co.,Ltd.	DWG. NO.: E-11



SYMBOL DESCRIPTION

: OUTDOOR LIGHTING BOARD

: HANDHOLE
600×600×900 W/COVER



PROJECT TITLE	PREPARATORY SURVEY ON THE PROJECT FOR REINFORCEMENT OF TRANSMISSION LINE IN NACALA CORRIDOR IN THE REPUBLIC OF MOZAMBIQUE	SCALE	1/800
GENERAL NOTE		DATE	Aug. 2014
		DRAWN BY	
		CHECKED BY	
		DWG. TITLE	OUTDOOR LIGHTING SYSTEM PLAN
		DWG. NO.	E-12
			Oriental Consultants Global Co.,Ltd. / Tokyo Electric Power Services Co.,Ltd.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Procurement Policy for the Equipment

The basic policy for the procurement of equipment is as follows.

1) Equipment from Japanese Manufacturer
In case the equipment has a need for high reliability, Japanese manufacturers' products have a technical advantage on reliability, and such equipment should be procured from a Japanese manufacturer.

2) Equipment from Third Country Manufacturer
In case the cost can be reduced on the equipment for general use manufactured by a third country manufacturer, such equipment should be procured from the third country manufacturer.

Based on this basic policy, procurement of equipment is defined as follows:

a) The following main substation equipment is specified to comply with JEC standards due to the necessity of high reliability and technical expertise of Japanese manufacturers.

- 110 kV SF6 Gas CB of dead-tank type
- 110 kV/33 kV 40MVA Main Transformer

And the SCADA system is also specified to be supplied by Japanese manufacturers due to its technical expertise and its potential for expansion in the Mozambique power sector.

b) Other equipment listed below is specified to comply with the IEC and/or the International Standard to afford the benefits of international competitive products supplied by third county manufacturers as much as possible.

- 110kV Disconnector, CT, VT Surge Arrester, 110kV busbar, Conductor and Steel Structure
- 33kV Distribution Switchgear, Power Cable, Conductor
- Protective Relay, Switching Board, Control Cable and Metering Device
- Substation In-house Load, Emergency Generator, Battery and auxiliary facilities
- PLC including Line Trap device
- New Transmission Tower and Temporary Tower
- Distribution Transformer for electrification of communities
- Other necessary materials

All products shall be satisfied with a bid specification and easy maintenance, and the supplier shall have a good service support system for trouble-shooting, repairing, and providing spare parts with a reasonable response time.

The manufacturer has responsibility for all work such as equipment installation, commissioning test and adjustments, and introductory training for the O&M. Construction labor work shall be done by local workers under the supervision of Japanese expert engineers.

(2) Procurement and Implementation of a 33kV distribution line construction from the Namialo substation

A 33 kV distribution line will be constructed by a local company with sufficient experience in the EDM distribution work under the supervision of a Japanese contractor. Distribution line materials will be procured in Mozambique.

(3) Procurement and Implementation of a distribution transformer for the electrification of communities

A distribution transformer for non-electrified communities will be also installed by a local company with sufficient experience in EDM distribution work under the supervision of a Japanese contractor. Installation materials will be procured in Mozambique.

(4) Execution Policy for Building Facilities

As mentioned in section 2-2-1.(4), a local contractor will be utilized for the construction of building facilities, and one experienced Japanese civil and building engineer will be stationed to supervise the local contractor's work.

2-2-4-2 Implementation Conditions

(1) Transportation of Main Transformer

The main transformer of 110 kV/33 kV 40 MVA capacity weighs about 50 tonnes including the cargo frame. Therefore, it should be transported with special care to avoid serious mechanical shocks from either horizontal or vertical stress. Especially regarding inland transportation from the nearest port to the site, consultation and coordination with the road authority and police are indispensable since the special multi-axle trailer travels with restricted low speed for safety.

The new Namialo substation will be located 1.5 km away from the Nacala corridor road (EN12) and there is no access road from EN12 to the site. Therefore, it is necessary to construct a temporary access road during the construction period, and it should be durable against the load from transporting the main transformer.

Furthermore, there is a railway across said access road; therefore, a railway crossing must be constructed that is also able to withstand the load of transporting such heavy equipment.

(2) Substation Construction Works

First of all, the project site will be cleared and leveled by construction machinery such as backhoes and cranes with long arms. At this time, special care must be taken to avoid contact with existing live transmission lines above the site.

Prior to the commencement of equipment installation, existing transmission lines will be detoured to clear the space above the construction site as mentioned in section 2-2-2-1-2. However, detoured lines are still close to the working area; therefore, special attention is necessary in order to avoid electricity accidents caused by contact with live lines.

(3) Power Supply to the Project Site for Construction Works

There are no distribution lines and households around the substation site. During the substation construction work, many electric devices will be used, such as electrical construction tools, testing equipment and site office appliances. Outdoor lighting at night is also needed for site security. Since a power supply is necessary prior to the commencement of the work, after the conclusion of the contract, the Japanese contractor will construct the 33 kV distribution line from the existing lines from EN12 to the site and install the LV temporary transformer at the site.

(4) Confirmation of 110kV lines schedule outage

During the construction of the Namialo substation, power transmission by existing 110 kV transmission lines must be suspended several times for detours and connections to the new substation. Human error due to misunderstanding the condition of transmission lines may cause a serious accident. It is very important to communicate with EDM operators and maintenance staff in order to confirm the outage schedule, operation procedures, and also the emergency communication network since the power source substations are located 80~100km away from the site. Safety first is a crucial issue for this project.

(5) Coordination with Recipient Country

1) Securing and Levelling of the Land

The project site for construction of the Namialo substation and access road from EN12 is mostly within the ROW (Right of Way) of an existing 110kV transmission line. It was confirmed that the access road can be constructed within the ROW. However, the project site for the Namialo substation will go beyond the ROW partially. Therefore EDM is to obtain the approval of the land use for the

construction of the Namialo substation (approximately 1.88 ha), and also clear and level the land prior to the “Tender Announcement”.

2) Railway Crossing

There is a railway across the access road from EN12 to the project site. The EDM will allocate the budget and construct a railway crossing prior to the “Tender Announcement” in coordination with the CDN so that construction vehicles and machinery can pass over this railway.

3) Structural examination and reinforcement for existing transmission tower

The existing transmission lines will be transferred to new tension towers that will be constructed adjacent to the Namialo substation. This transfer of the lines will cause a slight bend of the lines (2~3 degrees) at existing suspension towers with the consequence of an additional load to these towers. Therefore, the EDM is to carry out a structural strength examination and necessary reinforcement for said existing suspension towers prior to the contract with a contractor.

4) 110kV transmission lines outage schedule

Power transmission by 110 kV transmission lines shall be suspended during the line transfer from the old tower to the new one and while drawing lines to the new substation. In such cases, the power supply to the Nacala and Metoro districts will be entirely suspended. Therefore, it is critically important to carefully coordinate and cooperate with the EDM on the schedule of such outage prior to the execution of the line transfer.

(6) Access Road to Site

As mentioned in the above sections, the EDM will secure, clear and level the land for the access road from the EN12 to the project site, and will also construct a railway crossing prior to the “Tender Announcement”. Then the Japanese contractor will prepare and maintain a temporary access road with the necessary slope from the EN12 to the existing ground level during the construction period. However, it should be noted that this temporary access road is only part of the temporary works for the construction of the new Namialo substation, and the EDM is still responsible for the preparation and maintenance of a permanent access road. Therefore, this temporary access road and the slope that will be prepared by the Japanese contractor should not be subject to their “Defect Liability”.

(7) Installation Schedule of SCADA System

There is no specific technical problem for the installation of the SCADA system at the new Namialo substation because it is a new station and there will be no power supply service during the installation of the SCADA system. On the other hand, for the installation of the SCADA system at the two existing

substations, Nampula Central and Nampula 220, the modifications and connections to the existing equipment which is normally under operation must be carried out, and it may cause an interruption of the power supply due to mal-connection and/or mal-operations. Therefore, the following special attention should be paid in order to assure the power supply service.

- Carefully investigate the existing control circuits and coordinate with substation operators for the scheduled outage of equipment prior to the cable connection and modification of control circuits.
- Clarify the interface points between the SCADA system and the existing control circuit with the EDM in advance, so that the responsibilities of both parties are identified prior to the execution of the work.
- Ensure the accuracy of data between the SCADA systems and examine the testing procedure prior to the testing of the connection between the host computer of Nampula Central and the remote terminal substations.
- Prepare the appropriate outage schedule of power transmission prior to attaching the line trap and connecting the coupling capacitors of the PLC to the transmission lines, since power transmission will be suspended when such work is executed.

2-2-4-3 Scope of Works

Division of Work for this project between Japan and Mozambique is shown in Table 2-10 below.

Table 2-10 Division of Works for the project between Japan and Mozambique

No.	Work	Jpn	Mzn
1.	Preparation for the Project		
1)	To secure the land (project site, temporary yard, access road, etc.)		○
2)	To compensate for firming and fruit trees		○
3)	To clear and level the site (site shall be cleared so that construction work can be started)		○
4)	To construct the railway crossing		○
5)	To approve the contract with the Japanese consultant and contractor (by CREE)		○
6)	To provide the power supply to the project site	○	
7)	To construct a gate and fence around the site		○
8)	To complete the governmental procedures required for tax exemption for the Japanese consultant and contractor		○
9)	To obtain the governmental permits required for the commencement of works		○

No.	Work	Jpn	Mzn
2.	Namialo Substation		
1)	To install, test and commission the substation equipment, and carry out the guidance for equipment operation and maintenance	○	
2)	To construct facilities (control building, guard house, and equipment foundations)	○	
3)	To construct new transmission towers next to the Namialo substation (2 permanent towers and 1 temporary tower)	○	
4)	To examine the strength of the existing transmission towers next to the new transmission towers and reinforce as needed		○
5)	To demolish existing unnecessary transmission towers	○	
6)	To dispose of demolished materials from the existing transmission towers		○
7)	To construct 33 kV distribution lines and connect them to the Namialo substation (4 lines)	○	
8)	To provide general furniture		○
9)	To prepare and maintain a permanent access road after the completion of the project		○
10)	To supply the water necessary for the operation of the Namialo substation after the completion of the project		○
3.	SCADA system		
1)	To install, test, and commission the SCADA system at the following sites and carry out the guidance for operation and maintenance ▪ Namialo substation ▪ Nampula Central substation ▪ Nampula 220 substation	○	
2)	To install, test, and commission a PLC at the following sites, and carry out the guidance for operation and maintenance ▪ Namialo substation - Nampula Central substation ▪ Nampula Central substation - Nampula 220 substation	○	
3)	To rehabilitate the existing distribution boards in the Nampula Central substation		○
4.	Distribution Transformers to Non-electrified Communities		
1)	To install distribution transformers	○	
2)	To construct 33kV distribution lines to distribution transformers	○	
3)	To construct 400V distribution lines from distribution transformers * Distribution line to 1 customer for each transformer will be constructed by the Japanese side	△*	○

No.	Work	Jpn	Mzn
5.	Common		
1)	Marine transportation of equipment to the port of Mozambique	○	
2)	Tax exemption and custom clearance of the products at the port of disembarkation		○
3)	Inland transportation of equipment from the port to the project site	○	
4)	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted/ be borne by the Authority without using the Grant funds		○
5)	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		○
6)	To ensure that the facilities and equipment be maintained and used properly and effectively for the implementation of the Project		○
7)	To bear all the expenses, other than those covered by the Grant, necessary for implementation of the Project		○
8)	To bear the advising commission of A/P paid to the Japanese bank for banking services based upon the B/A		○
9)	To bear the payment commission of A/P paid to the Japanese bank for banking services based upon the B/A		○

2-2-4-4 Consultant Supervision

(1) For Equipment

1) Manufacturing

The design and technical documents prepared by the contractor shall be checked and approved by the consultant engineer prior to the manufacturing of equipment.

2) Factory Test

For the main substation equipment assembled in Japan, a factory test shall be carried out at the manufacture's factory to assure the technical requirement and equipment performance before shipping. The test shall be arranged and executed by the manufacturer, and it shall be inspected by the consultant engineer.

For other equipment assembled in a third country, a factory test shall be carried out under the responsibility of the manufacturer, and the results of the factory test shall be checked out by the consultant engineer by reviewing testing documents for the confirmation of the requirement and performance of equipment.

3) Transportation

As for the main substation equipment manufactured in Japan, prior to shipping equipment, a pre-shipment inspection shall be carried out by the third party organization at the warehouse of the shipping port in order to check the equipment with the shipping documents.

And for other equipment supplied from a third country, a pre-shipment inspection shall be carried out by the contractor, and the result of inspection shall be submitted to the consultant inspection engineer.

4) Equipment Installation

a) Inspection at Arrival

At the arrival of the equipment, the contractor shall carry out the appearance inspection in the presence of a consultant engineer to check the condition of the equipment after delivery.

b) New Transmission Towers

For the erection of new transmission towers and transferring of transmission lines, the consultant engineer shall inspect the following items:

- Erection of new transmission towers
- Procedure for the transferring of transmission lines prior to the execution of field works
- Safety management for these works to avoid an accident

c) Substation Equipment & SCADA system

During the installation period of the substation equipment and the SCADA system, the consultant engineers shall inspect the following items:

- Foundations as per the drawings prior to the commencement of the equipment installation work
- Installation programme and progress
- Installation of equipment as per the drawings
- Safety management for the installation of equipment
- Environmental management by the Contractor

5) Commissioning Test and Test Operation

Soon after the completion of the equipment installation, a commissioning test and test operation shall be carried out by the contractor under the inspection of consultant engineers.

Finally, the function and quantity of installed equipment shall also be checked by the consultant engineer.

6) Handover

After the commissioning and testing as well as training the EDM staff under the supervision of the consultant engineer for operation and maintenance, the project will be accepted by the EDM and handed over to the EDM in the following procedure.

The project acceptance inspection by the EDM shall be carried out in the presence of the consultant engineer as well as the contractor who shall present the conformity of the equipment with the requirement stipulated in the specifications.

After the project is officially accepted by the EDM, the project will be handed over to the EDM with the necessary documents such as inspection records and the O&M manual.

(2) For Building Facilities and Equipment Foundations

Designs for the Control Building and foundations for each piece of equipment shall be finalized by the Contractor according to the requirements of the equipment. Therefore, such final designs should be checked by the consultant in Japan prior to the construction work.

During the construction period, the Japanese consultant will visit the site from time to time as needed, and the local consultant will be fully stationed at the site. They will carry out the following work:

- Supervise quality and progress
- Approve shop drawings and samples
- Inspect the field works
- Final inspection at the completion of the works

2-2-4-5 Quality Control Plan

Specific requirements for the quality control in this project are as follows:

(1) Transportation of the Main Transformer

There is a risk of damage to the windings support and other parts of the 110 kV/33 kV transformer due to an unexpected impact during the transportation. Therefore, the gravity acceleration measurement shall be attached to the transformer during te transportation in order to monitor the degree of impact to the transformer.

(2) Transformer Insulation Oil Management

The quality of the insulation oil used in the transformer is a key issue to assure the dielectric characteristics of the transformer. While oil is transported in a drum, there is a possibility of water infiltration depending on the transportation conditions and drum quality. If deteriorated oil is used in practice, it may cause the insulation to break down resulting in electrical failure. In order to prevent such incidents, the appearance of the oil drum and oil characteristics shall be checked and analyzed at its arrival to the site. Then, water shall be drawn off the oil through a vacuum pump to ensure the oil quality.

(3) CB (Circuit Breaker) Transportation

There is a risk of damage to the CB mechanical link and contactor of the 110 kV CB during transportation. Therefore, the gravity acceleration measurement shall be attached to the CB during the transportation to monitor the degree of impact to the CB.

(4) CB (Circuit Breaker) Quality Management

The 110 kV CB has SF6 gas in its tank for insulation and arc-breaking function. SF6 gas management is very important for CB performance. The CB shall be transported with SF6 gas depressurized to the atmospheric pressure and the CB shall be re-filled with SF6 gas at the rated pressure at site. If re-filling is missing, it may cause the destruction of CB. Therefore, it is very important to check the SF6 gas pressure at the end of the installation work and commission test.

2-2-4-6 Procurement Plan

(1) For Equipment

Among equipment for the project, the 110kV SF6 Gas CB and Main Transformer are specified as JEC standard, and the SCADA system is provided by the Japanese manufacturer. The other general substation equipment, such as the Disconnector, 33kV switchgear and relay devices, transmission tower, PLC device, and distribution transformer, are allowed to be procured from third country suppliers.

The specification of equipment is prepared without any special requirements so that experienced manufacturers in Japan and third countries can supply the required equipment. Requirements for spare parts include the supply of a lamp and fuse as consumable items and a CB trip coil for easy maintenance by the EDM operating staff.

Since troubles in a new substation mostly occur within one year from the commissioning, the defect liability period is defined as one year for the free service from the manufacturer against defects.

(2) For Building Facilities

Generally in Mozambique, most of the materials for civil and building works are imported from South Africa except for cement and concrete, and buildings and foundations for this project can be constructed by locally available materials and ordinary imported materials generally used for common civil and building works.

(3) Equipment and Materials to be imported from Third Countries

For the implementation of the project, the following equipment and materials will be imported from third countries.

Table 2-11 Items which will be procured from third countries

No.	Item	Country	Remarks
1.	Equipment		
1)	Substation Equipment except for the following major equipment from Japan ▪ 110/33kV Transformer ▪ 110kV CB ▪ SCADA System	Egypt, England, France, Germany, Italy, Singapore, South Korea, Spain, Sri Lanka, Sweden, Thai	Country of origin for each equipment cannot be specified at this stage. Project cost was estimated based on the assumption that equipment will be procured from these countries.
2.	Materials for the construction of facilities		
1)	Deformed bar	South Africa	
2)	Metal products (checkered plate, manhole cover, roof drain, etc.)	South Africa	
3)	Waterproofing material	South Africa	
4)	Metal doors and windows	South Africa	
5)	Finishing materials	South Africa	

2-2-4-7 Operational Guidance Plan

Introductory training for the operation of substation equipment as well as the SCADA system, daily maintenance procedures, and troubleshooting treatment to the EDM staff shall be provided by the manufacturer so that the EDM can smoothly operate and maintain the substation as well as the SCADA system by themselves after the handover of the project.

Since all of the equipment as well as the SCADA system are an ordinary type for the EDM, it is not necessary to develop a technical capacity building programme.

(1) Introductory Training for O&M

Introductory training for O&M is programmed as follows in respect to substation equipment and the SCADA system.

Table 2-12 Introductory Training Curriculum

Equipment	Training personnel	Training days	Contents
Substation equipment in general	15 people	0.5 day	Outline of substation equipment and O&M introduction
Dead-tank type SF6 gas CB	15 people	0.5 day	CB structure and O&M introduction
SCADA system	45 people	1.5 day	SCADA system architecture and its basic operation and maintenance

(2) O&M Technical Training

O&M technical training is programmed as follows.

Table 2-13 O&M Technical Training Curriculum

Equipment	Training personnel	Training days	Contents
Substation equipment in general	15 people	1.0day	Maintenance and equipment management Troubleshooting
Dead-tank type SF6 gas CB	15 people	0.5day	ditto
Protective relay	15 people	1.0day	Relay setting, maintenance and equipment management Troubleshooting
SCADA system	45 people	6.0day	System operation, hardware maintenance and system management Troubleshooting

2-2-4-8 Implementation Schedule

Implementation schedule of this project is shown in the next page.

THE PROJECT SCHEDULE FOR THE REINFORCEMENT OF TRANSMISSION NETWORK IN NACALA CORRIDOR

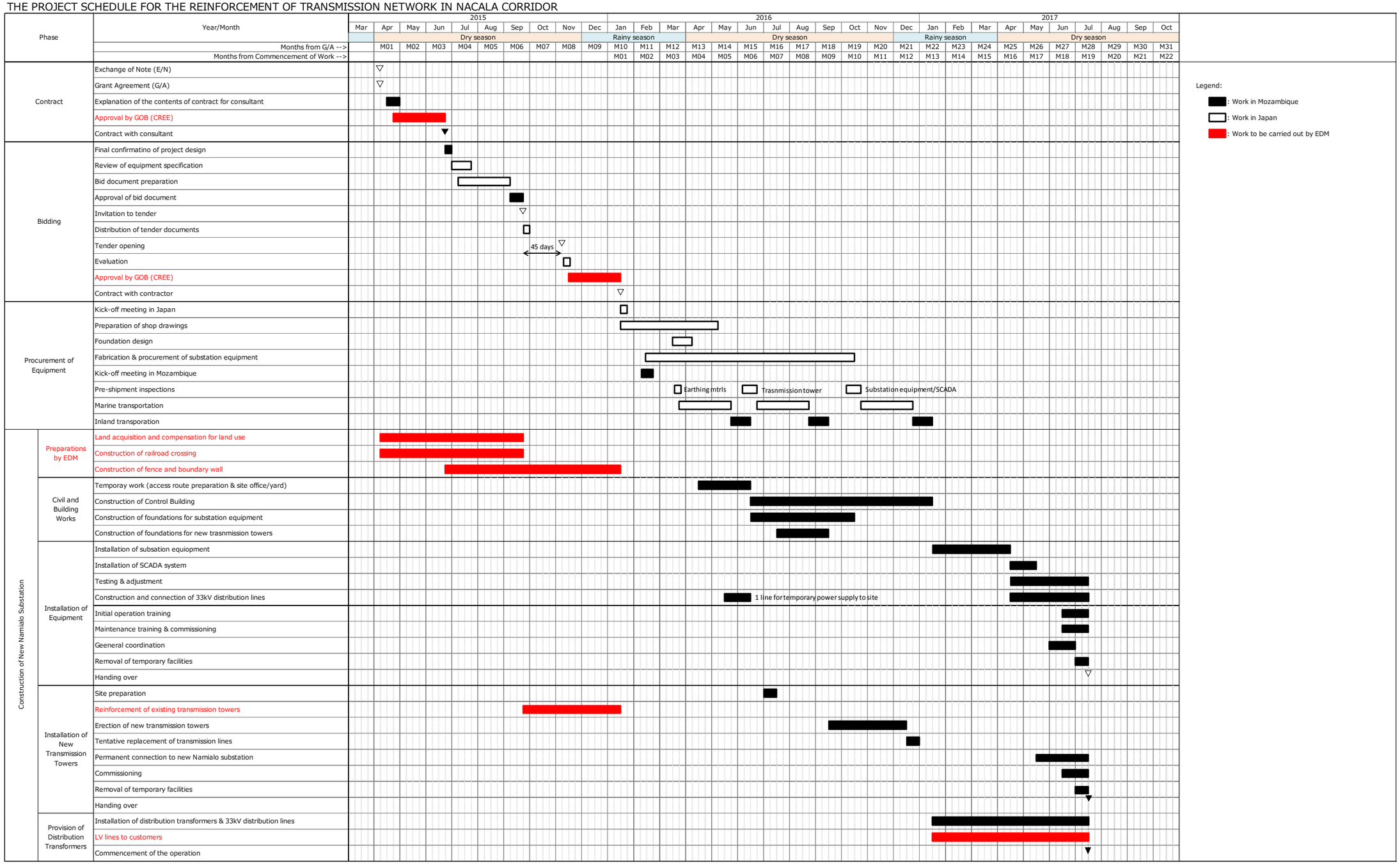


Figure 2-18 Project Implementation Schedule

2-3 Obligation of Recipient Country

Outlines of the works to be undertaken by Mozambique site are described below.

(1) Land Preparation

According to Japan's grant aid scheme, the EDM is responsible for the acquisition, clearance and leveling of the project site. As mentioned in section 2-2-4-2 (5) 1), the project site for the Namialo substation will go beyond the ROW partially. Therefore EDM is to obtain the approval of the land use for the construction of the Namialo substation (approximately 1.88 ha), and also clear and level the land prior to the "Tender Announcement".

(2) Land Use Compensation

There are no inhabitants to be resettled on the project site; however, there are some people around the project site who make a living with farms and fruit trees within the project site. Therefore, the EDM will compensate such people for the loss of their livelihood as per the SLUCP (Simplified Land Use Compensation Plan) mentioned in section 1-4-2. It should be completed prior to the "Tender Announcement".

(3) Construction of Railway Crossing

There is a railway across the access road from the EN12 to the project site as shown in the photograph below.

Figure 2-19 Railway across the access road from the EN12 to the project site

As mentioned in section 2-2-4-2 (5) 2), the EDM is to allocate the budget and construct a railway crossing prior to the "Tender Announcement" in coordination with the CDN so that construction vehicles and machinery can pass over this railway. An actual example of a railway crossing is shown in the photograph below.

Figure 2-20 Actual railway crossing

(4) Construction of Boundary Wall and Gate

According to Japan's grant aid scheme, the EDM is responsible for the construction of a gate and fence around the project site. In consideration of security during the construction period, it should be completed prior to the contract with a contractor.

(5) Structural Examination and Reinforcement of Existing Transmission Tower

As mentioned in section 2-2-4-2 (5) 3), the existing transmission lines will be transferred to new tension towers which will be constructed adjacent to the Namialo substation. This transfer of the lines will cause a slight bend of the lines (2~3 degrees) at existing suspension towers, with the consequence of an additional load to these towers.

These existing transmission towers were constructed by the EDM and their design documents, including structural calculation, should be with the EDM.

Therefore, the EDM is to carry out the structural strength examination and necessary reinforcement for the existing suspension towers prior to the contract with a contractor.

(6) Works to Install and Operate Distribution Transformers to Non-electrified Communities

Installation of distribution transformers to non-electrified communities, connection from the existing 33 kV line to the transformers, and one LV connection to the priority customers for each transformer will be carried out by the Japanese side, in order to ensure the effective use of the transformers at the end of the project.

As for the new LV connections for other ordinary customers, EDM is to design the works, allocate the budget, and complete the construction and connections by the time of project completion.

(7) Works to Operate New Namialo Substation

This project shall provide the facilities to receive 110kV lines, transfer the power to 33kV, and feed 33kV distribution power to 33kV switchgears at new Namialo substation. The 33kV distribution lines (4 circuits) from the Namialo substation to the existing lines will be constructed by the Japanese contractor. However, new additional distribution lines which would be required after the completion of the project shall be constructed by EDM to meet the increasing power demand in the future.

(8) Preparation of Permanent Access Road

As mentioned in the section 2-2-4-2 (6), the Japanese contractor will prepare and maintain a temporary access road; however, the EDM is still responsible for the preparation and maintenance of a permanent access road.

(9) Tax Exemption

According to the surveys, in the case of another Japanese grant aid project in Mozambique, the customs duties are paid by the related authorities, and the Japanese contractor will get a refund for any paid VAT. Therefore, if the same procedures for tax exemption are applied to this project, the EDM will ensure the budgetary allocation for customs duties and complete the necessary governmental procedures necessary for a smooth VAT refund prior to the contract with the Japanese consultant and contractor.

(10) Approval of Agreement and Contract

An agreement with the Japanese consultant and a contract with Japanese contractors for the project need to be approved by CREE (Commission for Foreign Economic Relations), and it will take two months for each approval. EDM is to coordinate with related authorities and ensure the punctual approvals.

2-4 Project Operation Plan

(1) Organization and Responsibility

After the construction, the new Namialo substation will be managed by the Northern region Grid department under the Transmission Division of the EDM headquarters.

Operators for this new substation will be basically selected from the existing operation staff in the Northern region grid or newly employed if necessary under the EDM’s responsibility.

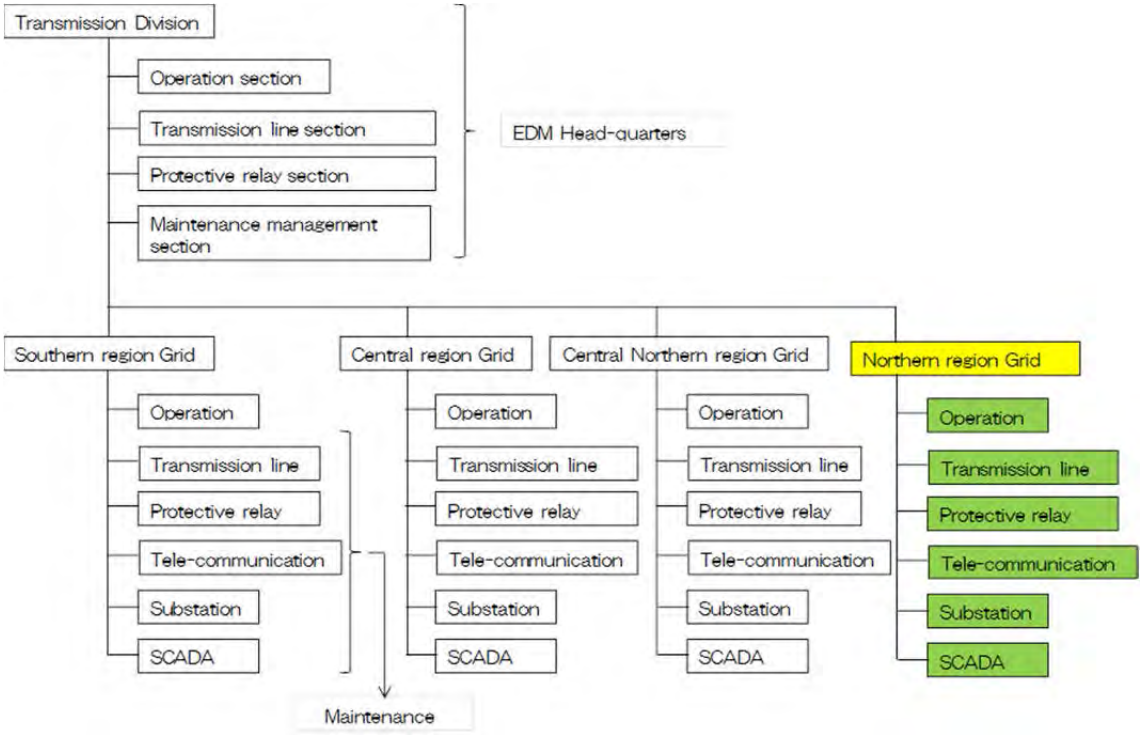


Figure 2-21 EDM's Organization for Operation and Maintenance

(2) Human Resources Required for Operation

The EDM's substations are normally operated by 3 shifts for 24 hours (5:00 ~ 13:00, 13:00 ~21:00 and 21:00 ~5:00) with a total of 9 operating staff people (2 per shift x 4 teams with 1 extra staff person).

For the Nampula Central and Nampula 220 substations, such operating staff people are duly secured.

(3) Organization for Maintenance

The new Namialo substation shall be maintained by the maintenance team of the Northern region grid department. This maintenance team is basically stationed at the Nampula Central substation and consists of 16 people for the transmission line, 5 people for the protective relay, 2 people for telecommunications, and 4 people for the substations and SCADA system respectively.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Cost to be born by the Recipient Country

Total cost for the works to be borne by Mozambique side is estimated at about MZN 16.5 million (about JPY 54.75 million). Details are as shown below.

Table 2-14 Cost to be born by the recipient country

Item	Million MZN	Million JPY
Land preparation	0.500	1.500
Land use compensation	1.200	4.000
Construction of railway crossing	0.300	1.000
Construction of gate and fence	2.700	9.000
Structural examination and reinforcement of existing transmission towers	1.800	6.000
Disposal of demolished transmission tower materials	0.300	1.000
Construction of 33kV distribution lines	3.000	10.000
Installation of LV distribution lines in two non-electrified communities	3.000	10.000
Provision of general furniture	0.200	0.750
Commissions to Bank	0.800	2.500
Preparation of Permanent Access Road	2.700	9.000
Total	16.500	54.750

It should be noted that the following costs are also to be born by the EDM as needed.

- Cost for the supervision of the project implementation by the EDM
- Cost for the factory inspection of equipment by the EDM in Japan and/or third countries such as airfare and lodging expenses

(2) Basis of the Cost Estimate

The basis of the cost estimate is as follows:

1) Base date : June 2014

2) Exchange Rate : 1 US Dollar = JPY 103.22
1 Euro = JPY 142.45
1 Mozambique Metical = JPY 3.33

3) Project implementation period : See Implementation Schedule shown in the section 2-2-4-8.

4) Others : The Project will be implemented in accordance with the procedures of grant aid projects of the Japanese Government.

2-5-2 Operation and Maintenance Cost

(1) Necessary Cost

Personnel expenses for substation operation are estimated at 5.7 Million MZN/year and the maintenance cost is about 2.7 Million MZN/year. Total cost is 8.4 Million MZN/year.

Table 2-15 Annual Operation and Maintenance Cost for the Namialo substation

Item	Contents	Annual cost（Million MZN）
Personnel expense for substation operation	Operator : 8 people Technical staff : 1 person	5.7
Maintenance cost	Routine maintenance check and overhaul of substation equipment Routine maintenance check and overhaul of 3 sets of the SCADA system	2.7
Total	-	8.4

(2) Budget Allocation

The operation and maintenance cost above is about 3% of the EDM's profit before tax and it would be a bearable amount for the EDM. The income statement of the EDM in 2012/2011 is shown in the table below.

Table 2-16 Income Statement of the EDM (2012/2011)

Item	Amount (MZN)	
	2012	2011
Revenue	8,495,613,933	7,352,388,971
Cost of sales	2,791,670,628	2,460,513,712
Gross income	5,703,943,305	4,891,875,259
Staff costs	1,693,434,352	1,391,462,519
Supplies and services from third parties	2,038,779,398	1,472,902,015
Depreciation and amortisation	1,421,696,912	1,385,527,781
Provisions	306,951,641	248,390,486
Other income and operating losses	123,856,873	174,859,143
Subtotal	5,337,005,430	4,323,423,658
Operating income	366,937,875	568,451,601
Financial income	421,028,739	1,046,978,430
Financial expenses	488,680,811	793,235,769
Net financing income/expense	-67,652,072	253,742,661
Profit before tax	299,285,803	822,194,262
Income tax	194,761,993	184,671,152
Net profit for the year	104,523,810	637,523,110