Federal Ministry of Power, Works & Housing (FMPWH)
Transmission Company of Nigeria (TCN)
The Federal Republic of Nigeria

PREPARATORY SURVEY REPORT
ON
THE PROJECT
FOR
EMERGENCY REHABILITATION AND REINFORCEMENT OF LAGOS TRANSMISSION SUBSTATIONS
IN THE FEDERAL REPUBLIC OF NIGERIA

FEBRUARY 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the Preparatory Survey on the Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substations in the Federal Republic of Nigeria and entrust the survey to Yachiyo Engineering Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Nigeria, and conducted field investigations from July, 2017 to December, 2017. 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 Nigeria for their close cooperation extended to the survey team.

February, 2018

Toshiyuki NAKAMURA

Director General,

Industrial Development and Public Policy Department

Japan International Cooperation Agency

SUMMARY

SUMMARY

1. Outline of the Country

Nigeria comprises an area of 924,000 km^2, and has a population of about 187 million people (2016 U.N. population white paper), and the latest economic statistics show that it has the largest economy in Africa. The country is divided into two major characteristic climatic regions, the semiarid sub-Saharan region in the north, and the wetlands in the south. Nigeria is home to more than 250 different ethnic groups, and the national religious distribution is about 50 % Muslim, about 40 % Christian, and about 10 % indigenous religions. The Islamic influence grows more prevalent further to the north. English is used as an official language.

Nigeria is the largest producer of oil in Africa, ranked as the 7th-highest oil producer among the members of OPEC (the Organization of Petroleum Exporting Countries). However, the price of crude oil has been falling since 2014, so in recent years, Nigeria's economic growth has stagnated, and in 2016, the country reported negative growth of -1.54 %. As shown in a breakdown of the 2016 nominal GDP, the country has a relatively well-balanced industrial structure, manufacturing accounting for the largest share at 34 %, followed by finance and insurance at 26 %, agriculture at 21 %, and other services at 19 %.

2. Background, History and Outline of the Project

Lagos State is the center of Nigeria's economy, and currently experiencing rapid growth. It has a population of about 9 million people (source: 2006 national census), and is the country's largest port. Demand for electric power in Lagos State currently stands at 1,250 MW, but the average power supply is only 650 MW (source: Lagos State Electric Power Committee). Amid this dire power shortfall, forced power outages caused by grid overloads are a common occurrence throughout the state, and accidents causing grid-wide outages also occur due to lack of facilities maintenance. The Apapa Road substation in Lagos State supplies the power to the facilities, circumjacent industrial areas, private homes in the vicinity of Apapa, and port facilities including the Nigeria's largest port, Apapa port which handles 40 % of Nigeria's imports (Source: National Bureau of Statistics). However, in addition to a lack of power generation capacity, this substation lacks sufficient transforming capacity, which causes insufficient power supply and inhibits port businesses and industrial activities. This means that an expansion of transforming capacity is urgently needed. Also, this substation has been in operation for 35 years and its gas insulated switchgear (hereinafter referred to as "132 kV GIS"), which functions to protect the grid and monitor the controllers, is aging. In 2012, the device broke down and stopped functioning. Therefore, there is an increasing risk that a short-out or other troubles in the emergency circuit breaker could cause major damage to grid facilities, which could lead to a prolonged blackout. A prolonged blackout would have a serious impact on the port and surrounding industries, so the 132

kV GIS facility should be restored as soon as possible.

In the national development plan "Nigeria Vision 20: 2020," the Nigerian government cites electric power and transport infrastructure installation as a top-priority issue. The Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substations (hereinafter referred to as "the Project") will upgrade transformer capacity and restore 132 kV GIS facilities, thereby improving the power distribution network. As such, it is positioned as a national development plan priority project.

Due to the circumstances detailed above, the Nigerian government has petitioned the Japanese government for aid in repairing the Apapa Road substation in order to stabilize the supply of electric power to Lagos.

3. Outline of Survey Result and Content of the Project

Receiving the above petition, JICA dispatched a preparatory survey team to Nigeria from July 30th,2017 to August 2017, and also from November 18th, 2017 to November 22nd, 2017 (additional site survey), the team reconfirmed and scrutinized the request and discussed the contents of implementation with Nigerian related organizations (Supervising organization: Federal Ministry of Power, Works and Housing (FMPWH), Implementation Agency: Transmission Company of Nigeria (TCN), and surveyed the Project site and collected related documents.

After returning to Japan, the team studied the necessity, urgency, social & economic benefits, and validity of the Project, and compiled the results in the preparatory survey report (draft). JICA dispatched the second survey (for outline explanation) team to Nigeria from December 3rd, 2017 to December 17th, 2017, and the team explained and discussed about the preparatory survey report (draft) and had acquired preliminary agreement with Nigerian relative organizations.

As a result of the survey, the Project will be composed of procurement/installation of substation facilities such as 132/33 kV transformer with 60 MVA capacity, 132kV Gas Insulated Switchgears (GIS) and 33kV Gas Insulated Switchgears(GIS) at Apapa Road Substation, procurement /installation of 132 kV transmission line T branching equipment material at Akangba Substation, and foundation for installment of each equipment, and civil/construction work such as control building where 132 kV GIS, control and protection and 33kV GIS will be installed. In addition, the Project will be also composed of procurement of spare parts regarding procured equipment. The outline of basic plan is shown the below table.

Outline of Basic Plan

	Equipment	Unit	Q'ty
Procurement of equipment and Installation	1. Apapa Road Substation		
	1) Equipment of 132 kV incoming transmission line		
	120 kV lightning arrestor	Set	2
	132 kV broking coil	Unit	2

	Equipment	Unit	Q'ty
	132 kV Capacitor voltage transformer	Set	2
	132 kV Cable head	Set	3
	132 kV Power cable	Set	1
	132 kV Power cable support	Set	1
	2) 132 kV GIS and transformer		
	132 kV Incoming GIS	Set	2
	132 kV Bus coupler GIS	Set	1
	132 kV Voltage transformers GIS	Set	1
	132 kV Transformers feeders GIS	Set	2
	132/33 kV Transformers	Unit	2
	3) Control and protection		
	132 kV Incoming GIS control and protection panel,	Set	2
	132/33 kV Transformer GIS control and protection panel	Set	2
	132 kV Bus coupler GIS protection panel	Set	1
	Energy meter panel (Power meter is supplied by Customer)	Panel	1
	Supervisory control panel (RTU)	Panel	1
	SCADA system (For substation)	Set	1
	4) 33 kV Gas Insulated Switchgears (GIS)		
	33 kV GIS for incoming feeders for transformer	Panel	2
	33 kV GIS for distribution feeders	Panel	6
	33 kV GIS for bus coupler		
	33 kV GIS for bus coupler (CB)	Panel	1
	33 kV GIS for bus coupler (Bus riser)	Panel	1
	33 kV GIS for voltage transformer	Panel	2
	33 kV Power cable	Set	1
	33 kV Ring main unit	Set	1
	5) Other incidental facilities		
	DC110V Power supply system (Include normal, standby)	Set	1
	AC Power supply system (Include normal, standby)	Set	1
	Substation Earthing	Set	1
	Grounding transformer (For internal transformer)	Unit	2
	Emergency generator	Unit	1
	Overhead traveling crane	Set	1
	Other, control cables etc.	Set	1
	6) Civil and Construction Work		
	Foundation work for Procured equipment (132kV Power cables support, 132/33 kV Transformers, Grounding transformer, Emergency generator)	Set	1
	Control Building (132kV GIS, Control and protection, Building for 33kV GIS)	building	1
	Akangba Substation		
	132 kV transmission line T branching equipment material		
	132 kV transmission gantry	Set	1
	132 kV transmission material	Set	1
Procurement of equipment	2. Test and Maintenance Equipment		
	Transformer insulating oil vacuum degassing device (including tank etc.)	Set	1

	Equipment	Unit	Q'ty
	Transformer oil withstand voltage tester	Set	1
	Protective Relay Tester	Set	1
	SF6 Gas handling unit for GIS	Set	1
	Power meter	Set	1
	Aerial work platform	Unit	1

4. Construction Schedule and Initial Cost Estimation of the Project

The total cost borne by Nigerian side for the Project under the Japan's Grant Aid scheme is about 100 million yen. The main costs borne by Nigerian side thereof are Land rental for mobile station and removal of fences (about 5.8 million yen), Removal working in the substation (about 4.5 million yen), Relocation of existing 33 kV,11 kV cables(about 2.3 million yen), Removal working of existing 132/33 kV transformer, firewall, temporary switching device(about 6.2 million yen), Removal working of mobile substation and installment of new fences(about 2.6 million yen), Guards(about 10million yen), Switching connection of 33 kV cable(about 16 million yen), Police(about 10 million yen), Bush cutting work and leveling(about 5 million yen), Fees for Bank Opening Account (B/A) and Agency Payment Fee (A/P)(about 3 million yen), Payment of Taxes (CISS and ETLS)(about 23 million yen). The Project will be implemented as B-national bond project and the total period of construction schedule will be 39.0 MM.

5. Project Evaluation

[Relevance]

As shown below, the Project will contribute to the realization of Nigerian development plan and Nigerian Economic Recovery and Growth Plan, and bring benefits to the general public. Therefore, the relevance of the Project is considered high.

1) Population of Benefits

Implementation of the Project will enable stable and good-quality electricity to be supplied to about 223,000 residents in Apapa area (National Population Commission of Nigeria, 2006 census).

2) Urgency

At present the function of 132 kV GIS at Apapa Road Substation has been completely halt owing to breakdown. Thus, as alternative of 132 kV GIS, gas insulators has been installed by temporally bypassing circuits, and the state of provisional power receiving has been continuing.

This substation has not played an ordinary role as substation because the substation has lacked the necessary facilities (protection devices, switching devices, meters and monitoring panels) and also it has lost power system protection function, monitoring control function and

maintainability. In case an accident occurs inside or outside (transmission system) of Apapa Road Substation, the accident can cause injury or death or develop to large blackout in wide area because the possible way to take is only to cope with the accident by tentative insulators or by power system protection function at upstream Akangba Substation. Moreover, while the accident is recovered, power outage for a long period of time will continue at consumer side (Lagos Port, Tin Can Island Port, Industrial areas, ordinary homes, and naval facilities) and in the end, non-utility generation facilities will be used. As a result, port operation, industries and lives of ordinary homes will have a financial difficulty because of high cost of fuel used in non-utility generation facilities. Thus, the urgency of the Project is high.

3) The Project Which Contributes To Nigerian National Development Plan

In the Nigerian national development plan, "Nigeria Vision 20: 2020", infrastructure development (power/ transport) has been declared as one of the top-priority issues. And also, in "Nigeria Economic Recovery & Growth Plan 2017-2020", the achievement of economic growth with global competitiveness has been declared as a strategic target, and fragile infrastructure has been pointed out as one of the hindrances to competitiveness of Nigerian economics, and also the necessity of investment of such infrastructures as power, roads, railroads, ports, internet (broadband) etc. has been emphasized. This project will contribute to these development plans as power infrastructure development.

4) Scheme of Japanese Grant Aid

It is possible that the Project will be executed without any specific difficulty because the Project has reasonable description of business and implementation schedule under the framework of the Japanese Grant Aid scheme with the fact that the country from which main equipment will be imported is Japan and that the Project will finish by the dead line of Exchange Note.

[Effectiveness]

Effects to be provided by the Project are as follows.

(1) Quantitative Effects

Indicator	Base Value (2017)	Target Value (2024) (3years from operation)
Electric energy at receiving end at Apapa Road Substation (GWh)	119	212
Times of power failure per customer (times / year)*[1]	132	80
Cumulative time of power failure per customer (time/year)*[1]	1,228	400

Note: *[1] Excluding power outage caused by upper systems than Akangba Substation (including power shortage of power stations)

(2) Qualitative Impacts (Overall Project)

Current state and issues	Steps to be taken (Cooperation project)	Level of effect and improvement
1. Non-utility generating facilities are used as a backup at port facilities at the time of power outages because the reliability of power supply from distribution networks is low and blackouts frequently occur. High fuel costs for non-utility generating facilities put port operation a burden. Moreover, unstable power supply causes decrease of productivity and efficiency in port businesses, and degradation of international competitiveness.	Power outages will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits.	Operation of port facilities will be economically improved by the decrease in usage of non-utility generating facilities with high fuel costs at Lagos and Tin Can Island Port owing to decrease in the numbers of power outages. Moreover, productivity and efficiency of port will be improved owing to decrease in blackouts, so time of discharge of freights and custom clearance will be curtailed, and international competitiveness will be upgraded. As a result, cargo handling volumes will be increased and Nigerian economy will grow.
2. Non-utility generating facilities are used as a backup at port facilities at the time of power outages because power supply from distribution networks is unstable and power outages occur frequently. In case of non-utility generating facilities by diesel, high fuel costs raise manufacturing costs, degrade international competitiveness in the industries, and lead to withdrawal of businesses and dismissal of employment, and in the end, cause collapse of Nigerian industries. Moreover, power supply from distribution networks comes much short of power demand, so the growth of industries and Nigeria is hindered.	Power outages will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits. Also, more power supply will be achieved by upgrading transformer capacities.	The stabilization of power supply in the Project will improve productivity and productive costs of industries, and international competitiveness, and in the end, it will contribute to resurgence of Nigerian economy and industry.
3. Many households use small non-utility generating facilities by gasoline as a backup owing to frequent blackouts. However, fuel costs of non-utility generating facilities are high, so low-income households owe large financial burden. Moreover, unstable power supply is one of the causes of no payment of electricity rates, and low billing collection rates will lead to operating money of power stations, and cause power supply shortage, which forms downward spiral.	Power outages will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits.	Remedy of power outages by the Project will contribute especially to the improvement of home economy of low-income households by the decrease in usage of non-utility generating facilities and fuel costs. Moreover, customer satisfaction will be improved and the collection rate of electricity bills will be upgraded.

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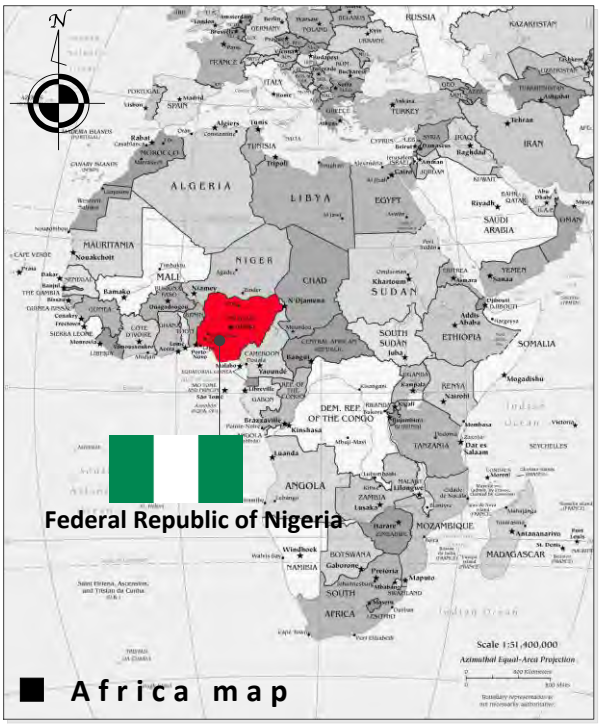
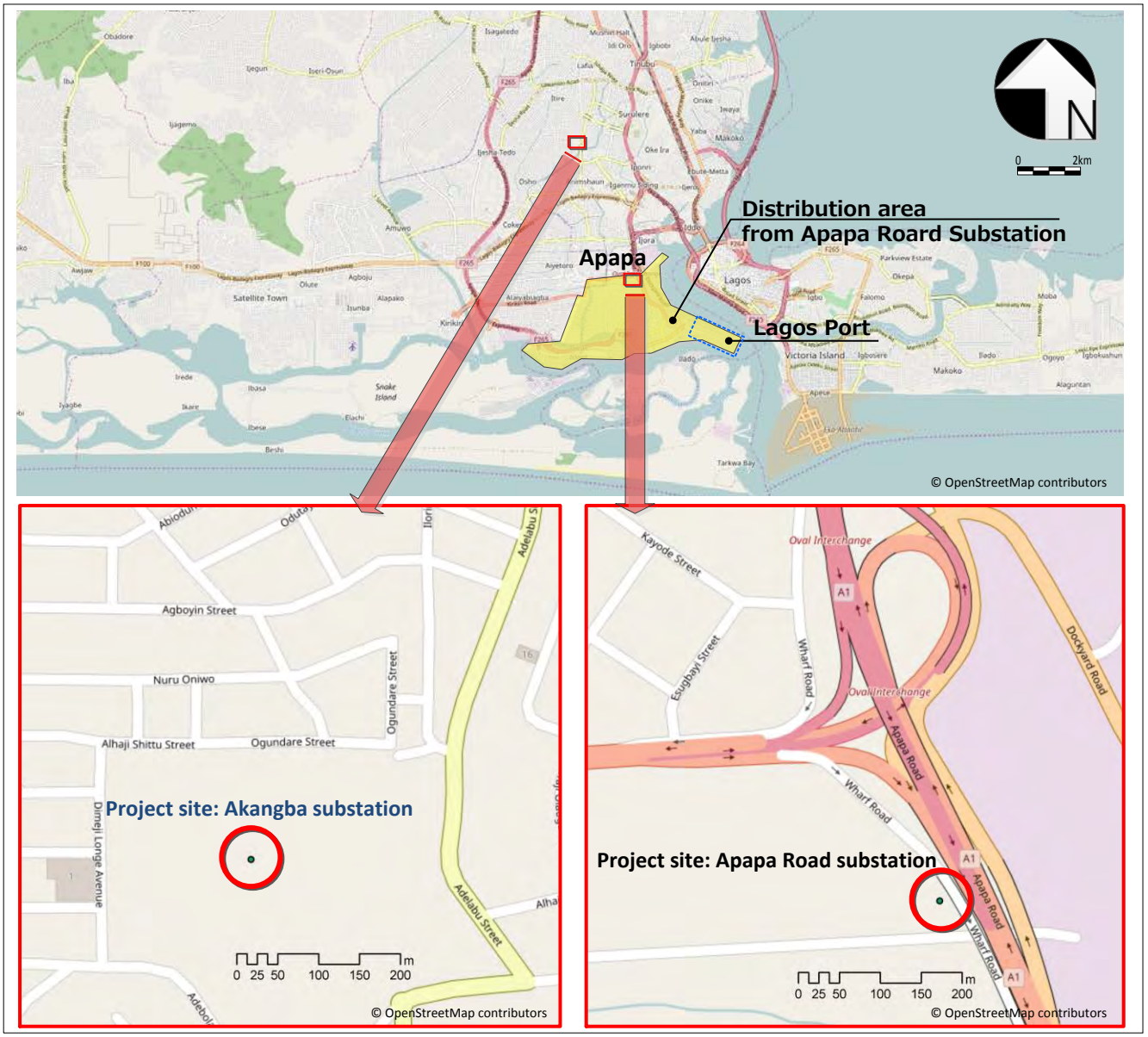


■ Africa map

■ Nigeria map



■ Project site map

Location map of project site

Conceptional drawing

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ABBREVIATIONS

AC	Alternating Current
ACSR	Aluminum Conductor Steel Reinforced
AFD	Agence Française de Developpement
AfDB	African Development Bank
BIL	Basic Insulation Level
CB	Circuit Breaker
CIF	Cost, Insurance and Freight
CISS	Comprehensive Import Supervision Scheme Charge
CIT	Companies Income Tax
CT	Current Transformer
CVT	Capacitor Voltage Transformer
DC	Direct Current
Disco	Distribution Company
EC	Employee Compensation
ECOWAS	Economic Community of West African States
E/N	Exchange of Notes
ERGP	Economic Recovery & Growth Plan
EPSERP	Economic and Power Sector Reform Program
ETLS	ECOWAS Trade Liberalisation Scheme
FIRS	Federal Inland Revenue Service
FMF	Federal Ministry of Finance
FMPWH	Federal Ministry of Power, Works and Housing
FOB	Free on Board
FY	Fiscal Year
G/A	Grant Agreement
GCB	Gas Circuit Breaker
GDP	Gross Domestic Product
Genco	Generation Company
GIS	Gas Insulated Switchgear
IEC	International Electro Technical Commission
ISO	International Organization for Standardization
ITF	Industrial Training Fund
IV	Polyvinyl Chloride Insulated Wires
JCS	Japanese Cable Maker's Association Standard
JEC	Japanese Electrotechnical Committee
JEAC	The Japan Electric Association
JEM	The Japan Electrical Manufacturers' Association
JICA	Japan International Cooperation Agency

JIS	Japanese Industrial Standards
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LTC	Load Tap Changer
NO	Normal Open
NC	Normal Close
NCS	Nigeria Customs Service
M/D	Minutes of Discussions
MDS	Main Distribution System
MCCB	Molded Case Circuit Breaker
MO	Market Operator
NBC	National Building Code
NBET	Nigeria Bulk Electricity Trading Plc
NEGIP	Nigeria Electricity and Gas Improvement Project
NEPA	National Electric Power Authority
NHF	National Health Fund
NHIS	National Health Insurance Scheme
NIPP	National Integrated Power Project
NPA	Nigeria Port Authority
O&M	Operation and Maintenance
ODA	Official Development Assistance
OJT	On the Job Training
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
OPEC	Organization of the Petroleum Exporting Countries
PCB	Poly Chlorinated Biphenyl
PHCN	Power Holding Company of Nigeria
PLC	Power Line Communication
PSRIP	Power Sector Recovery Implementation Program
PVC	Polyvinyl Chloride
RTU	Remote Terminal Unit
SBIR	States Board of Internal Revenue
SCADA	Supervisory Control and Data Acquisition System
SF^6	Sulfur Hexafluoride
SI Units	International System of Units
SO	System Operation
S/S	Substation
TCN	Transmission Company of Nigeria
TCS	Trouble Call System
TI	Temporary Importation

TITFA	Tertiary Education Trust Fund
TR	Transformer
TSP	Transmission Services Provider
VAT	Value Added Tax
VCB	Vacuum Circuit Breaker
WB	World Bank
WHT	Withholding Tax
XLPE	Cross-linked Polyethylene

CHAPTER 1 BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Appropriate Sectors and Target Sites: Current Status and Issues

1-1-1 Current Status and Issues

1-1-1-1 Electric Power Sector: Current Status and Issues

Nigeria has a population of about 187 million people (2016 U.N. population white paper), and the latest economic statistics show that it has the largest economy in Africa. In 2009, the Nigerian government established the national development plan "Nigeria Vision 20: 2020," with the aim of making Nigeria one of the top 20 economies in the world by the year 2020. This vision places particular importance on the electric power sector as a component of vital infrastructure for pursuing further socioeconomic development.

Due to the fact that in the past, sufficient maintenance, renovation and renewal were (have not been performed) not performed on electric power supply facilities, the electric power sector currently falls far short of meeting latent electricity demand. Scheduled blackouts are routine, and accidents causing grid-wide blackouts are a frequent occurrence. To address the situation, the Nigerian government implemented the National Integrated Power Project (NIPP), which uses the Excess Crude Account to construct thermal power plants and power lines. To further improve the efficiency of the electric power sector and lessen the investment burden on the government, the electric power sector is in the process of being privatized.

However, on the flip side of continued economic growth and concomitant increase in electric power demand, the instability of Nigeria's power supply is a continuing problem, and to the extent that this instability hinders economic activity and promotion to investment, the stabilization of the electric power grid is an urgent issue.

1-1-1-2 Electric Power Supply Status

As shown in Table 1-1-1, national peak power in Nigeria showed an average increase by 3.2 % year on year between 2005 and 2016. The highest peak power value on record was the 2016 value of 5,074 MW, but according to estimates based on a regional demand survey implemented in 2016, the actual peak power value for 2016 was 9,571 MW, and only about half the latent electric power demand was met. The average energy demand GDP elasticity value for developing countries is about 1.2-2.0, but Nigeria's GDP showed an average growth rate of 6.9 % between 2005 and 2014, and based on this growth, the growth rate in electric power demand is forecast to be 8 %-14 % per year. However, the actual growth rate was 3.2 % per year, meaning that it is estimated that Nigeria's electric power supply performance is falling far short of original demand.

Table 1-1-1 Electric Power Demand in Nigeria

Year	Peak Power		
	Performance	Estimated Value	Unmet Demand
	MW	MW	MW
2005	3,577	4,222	645
2006	3,508	4,756	1,248
2007	3,445	5,004	1,559
2008	3,166	5,473	2,307
2009	3,104	5,942	2,838
2010	3,717	6,411	2,694
2011	4,058	6,942	2,884
2012	4,288	7,631	3,343
2013	4,228	7,961	3,733
2014	4,299	8,563	4,264
2015	4,880	9,237	4,357
2016	5,074	9,571	4,497
Growth Rate 2016/05	3.2 %	7.7 %	19.3 %

[Source] Performance values were taken from the TCN supply performance records, and estimates were generated by a survey group based on a 2016 regional demand survey implemented by Transmission Expansion Plan (World Bank/Fichtner).

1-1-1-3 Electric Power Supply Facilities

(1) Power Generation Facilities

Table 1-1-2 shows an overview of existing power generation facilities, as well as those under construction and those for which contracts have been completed. The total rated output for existing power generation facilities is 12.5 GW (12,500 MW), but actual output is lower due to maintenance and rehabilitation, so current available power generation output is about 8 GW. When power generation facilities currently under construction are brought into operation and maintenance and rehabilitation projects are completed, the output is expected to rise to 12.1 GW in 2018. However, current restrictions on gas supply and power distribution network capacity mean that it will be difficult to take advantage of the full potential power generation capacity.

Table 1-1-2 Power Generation Facilities Overview
(Existing/Under Construction/Contract Completed)

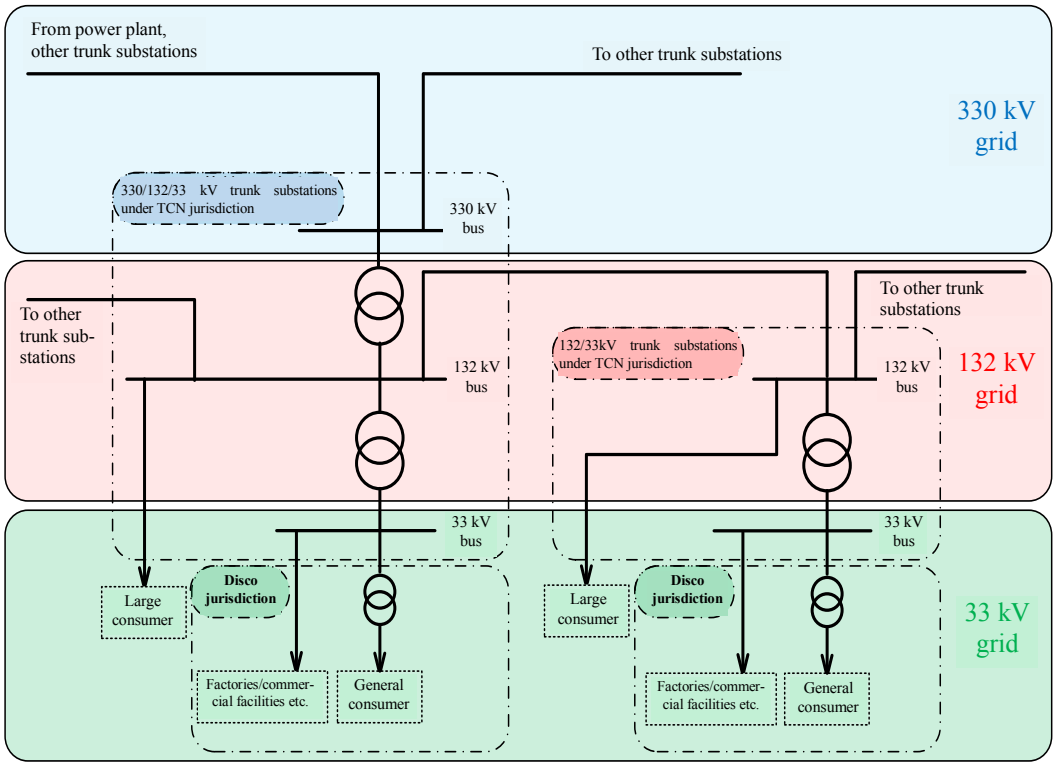
	Power plant name	Generation method	Start of operation	Unit No.	Unit output (MW)	Power plant output (MW)	Type	2017	2018	2019	2020	2021	2022	2023	2024	2025
Existing power plants	KAINJI-G7-10	Hydroelectric	1978	4	80	320	Hydraulic turbine	160	320	320	320	320	320	320	320	320
	KAINJI-G5-6	Hydroelectric	1968	2	120	240	Hydraulic turbine	0	240	240	240	240	240	240	240	240
	KAINJI-G11-12	Hydroelectric	1976	2	100	200	Hydraulic turbine	100	200	200	200	200	200	200	200	200
	JEBBA	Hydroelectric	1983-88	6	101	607	Hydraulic turbine	506	607	607	607	607	607	607	607	607
	SHIRORO	Hydroelectric	1990	4	150	600	Hydraulic turbine	450	600	600	600	600	600	600	600	600
	EGBIN	Gas	1985-1987	6	220	1320	Steam turbine	880	1,320	1,320	1,320	1,320	1,320	1,320	1,320	1,320
	SAPELE	Gas	1990	6	88	528	Gas turbine unit	450	528	528	528	528	528	528	528	528
	DELTA II-GT3-8	Gas	2002	6	24	143	Gas turbine unit	95	95	95	95	95	95	95	95	95
	DELTA III-GT9-14	Gas	2005	6	24	143	Gas turbine unit	143	143	143	143	143	143	143	143	143
	DELTA IV-GT15-20	Gas	1990	6	99	594	Gas turbine unit	297	297	297	297					
	AFAM IV-GT13-18	Gas	1982	6	88	528	Gas turbine unit									
	AFAM V-GT19-20	Gas	2002	2	138	276	Gas turbine unit									
	GEREGU FGN 1	Gas	2007	3	138	414	Gas turbine unit	414	414	414	414	414	414	414	414	414
	OMOTOSHO I	Gas	2007	8	42	335	Gas turbine unit	335	335	335	335	335	335	335	335	335
	OLORUNSOGO I	Gas	2007	8	42	335	Gas turbine unit	293	335	335	335	335	335	335	335	335
	GEREGU NIPP 1	Gas	2013	3	148	444	Gas turbine unit	444	444	444	444	444	444	444	444	444
	SAPELE OGORODE 1	Gas	2011	4	113	454	Gas turbine unit	113	454	454	454	454	454	454	454	454
	ALAOJI-NIPP	Gas	2013-14	4	120	480	Gas turbine unit	240	240	480	480	480	480	480	480	480
	OLORUNSOGO II	Gas	2011	4	126	504	Gas turbine unit	126	504	504	504	504	504	504	504	504
	OLORUNSOGO II	Gas	2012	2	127	254	Steam turbine	127	254	254	254	254	254	254	254	254
	OMOTOSHO II	Gas	2012	4	126	505	Gas turbine unit	505	505	505	505	505	505	505	505	505
	CALABAR/ODUKPANI	Gas	2015	5	113	565	Gas turbine unit	113	113	113	113	113	113	113	113	113
	IHOVBOR (EYAEN)	Gas	2013-14	4	113	452	Gas turbine unit	339	452	452	452	452	452	452	452	452
	OKPAI IPP	Gas	2005	2	150	300	Gas turbine unit	300	300	300	300	300	300	300	300	300
	OKPAI IPP	Gas	2005	1	150	150	Steam turbine	150	150	150	150	150	150	150	150	150
	AFAM VI-ST1	Gas	2005	1	230	230	Steam turbine	230	230	230	230	230	230	230	230	230
	AFAM VI-GT11-13	Gas	2009	3	166	498	Gas turbine unit	498	498	498	498	498	498	498	498	498
	IBOM 1	Gas	2009	1	42	42	Gas turbine unit	42	42	42	42	42	42	42	42	42
	IBOM 1	Gas	2016	1	40	40	Gas turbine unit	40	40	40	40	40	40	40	40	40
	IBOM 1	Gas	2010	1	114	114	Gas turbine unit	114	114	114	114	114	114	114	114	114
	AES BARGE	Gas	2002	9	31	279	Gas turbine unit	0	0	0	0	0	0	0	0	0
	OMOKU IPP	Gas	2006	6	25	150	Gas turbine unit	75	150	150	150	150	150	150	150	150
	TRANS-AMADI IPP	Gas	2010	4	25	100	Gas turbine unit	25	100	100	100	100	100	100	100	100
	RIVERS IPP	Gas	2012	1	191	191	Gas turbine unit	191	191	191	191	191	191	191	191	191
	GBARAIN-GT2 NIPP	Gas	2016	1	112	112	Gas turbine unit	112	112	112	112	112	112	112	112	112
	PARAS ENERGY	Gas		6	9	52	Gas turbine unit	52	52	52	52	52	52	52	52	52
	Existing power plants, Subtotal							7,960	10,380	10,620	10,620	10,323	10,323	10,323	10,323	10,323
Power plants under construction	ALAOJI 2+NIPP	Gas	2021	1	285	285	Gas turbine unit					285	285	285	285	285
	GBARAIN/UBIE I	Gas	2017	2	113	226	Gas turbine unit	226	226	226	226	226	226	226	226	226
	SAPELE ROT	Gas	2018	1	150	150	Gas turbine unit		150	150	150	150	150	150	150	150
	SAPELE ROT	Gas	2018	1	150	150	Gas turbine unit		150	150	150	150	150	150	150	150
	EGBEMAI-NIPP	Gas	2018	1	113	113	Gas turbine unit		113	113	113	113	113	113	113	113
	EGBEMAI-NIPP	Gas	2018	1	113	113	Gas turbine unit		113	113	113	113	113	113	113	113
	EGBEMAI-NIPP	Gas	2018	1	113	113	Gas turbine unit		113	113	113	113	113	113	113	113
	KADUNA IPP	Gas	2018	1	215	215	Gas turbine unit		215	215	215	215	215	215	215	215
	OMOKU-NIPP	Gas	2018	1	113	113	Gas turbine unit		113	113	113	113	113	113	113	113
	OMOKU-NIPP	Gas	2018	1	113	113	Gas turbine unit		113	113	113	113	113	113	113	113
	AZURA	Gas	2018		450	450	Gas turbine unit		450	450	450	450	450	450	450	450
	GURARA	Hydroelectric	2017	2	15	30	Hydraulic turbine	30	30	30	30	30	30	30	30	30
	DADINKOWA	Hydroelectric	2020	1	39	39	Hydraulic turbine				39	39	39	39	39	39
	Power plants under construction, Subtotal							256	1,786	1,786	1,786	2,071	2,071	2,071	2,071	2,071
Power plants for which contracts have been completed	BONNY+(MOBIL)(QIPP)	Gas	2026	4	130	520	Gas turbine unit									
	OMA POWER GENERATION COMPANY LTD	Gas	2023	3	150	450	Gas turbine unit							450	450	450
	PROTON	Gas	2023	2	172	344	Gas turbine unit								344	344
	PROTON	Gas	2023	1	156	156	Gas turbine unit								156	156
	CENTURY IPP*	Gas	2022	4	124	496	Gas turbine unit						496	496	496	496
	BRESSON Nigeria Ltd	Gas	2024	2	45	90	Gas turbine unit					90	90	90	90	90
	ZUMA	Coal	2022-2031	4	300	1200	Steam turbine						300	300	600	600
	Cummins Power Gen. LTD.	Gas	2023	1	150	150	Gas turbine unit							150	150	150
	MAMBILLA	Hydroelectric	2026-2033	10	305	3050	Hydraulic turbine									
	ZUNGERU	Hydroelectric	2023-2025	4	150	600	Hydraulic turbine							300	450	600
	Power plants for which contracts have been completed, Subtotal							0	0	0	0	90	886	1,786	2,736	2,886
Existing + under construction + contract completed power plants, Total								8,216	12,166	12,406	12,406	12,484	13,280	14,180	15,130	15,280

[Source] TCN

(2) Transmission Facilities

Though the electric power sector is in the process of being privatized, power distribution business in Nigeria is managed by the Transmission Company of Nigeria (TCN), under the jurisdiction of Federal Ministry of Power, Works and Housing (FMPWH). TCN is responsible for managing operation and maintenance for power lines and substations, grid operation, and electric power transactions.

The power distribution grid is made up of a 330 kV grid and a 132 kV grid. The 330 kV grid comprises the bulk power system, while the 132 kV grid comprises regional bulk power system. Voltage classes of grid substations are standardized at 330 kV, 132 kV, and 33 kV, and TCN manages everything down to 33 kV distribution feed-out points. Everything beyond this falls under the jurisdiction of the private power distribution company Disco. Figure 1-1-1 shows the basic structure of Nigeria's power system.



[Source] JICA Study Team

Figure 1-1-1 Structural Schematic of Nigeria's Power Distribution Grid

In Nigeria, 70 % of all power generation facilities are located in the southern Niger delta region where oil and gas are produced. However, there are no power resources in the northern region. Therefore, long-distance power lines carry power from the south to the north, resulting in a significant loss of voltage in the central and northern regions. In addition, most of the grid is organized in a "radial grid" structure, with power lines radiating outward from major power plants and substations, meaning that when breakdowns occur, there are no alternate power distribution routes, resulting in a low-reliability grid. As previously stated, the total power generation capacity is expected to increase drastically within the next few years, but since transmission capacity is not keeping pace with increase in generation

capacity, an upgrade of the power distribution infrastructure is urgently required.

1-1-2 Development Plan

1-1-2-1 Nigeria Vision 20:2020

In the national development plan "Nigeria Vision 20: 2020," the Nigerian government cites installation of infrastructure (electric power and transport) as a top-priority issue. The text of "Nigeria Vision 20: 2020" states, "In our long-term economic and development strategy, a stable and reliable use of electricity will be the key to long-term private continuing economic growth."

1-1-2-2 Nigerian Economic Recovery and Growth Plan (ERGP)

Due to the continued decrease in the price of crude oil since 2014, Nigeria has been in a recession since the second quarter of 2016. Between 2011 and 2015, the high average rate of economic growth (4.8 %) was largely maintained by the comparatively high price of crude oil and expanding oil consumption. However, the country continued to rely on crude oil for more than 95 % of its exports and foreign currency revenue, meaning that economic diversification was delayed. Other issues also faced the crude oil sector, including impediments to production in the Niger delta region, resulting in a loss of financial management ability to offset the recession and decreases in treasury and foreign currency revenue.

To break the deadlock in this situation and allow Nigeria to restart its economy, in February of 2017, the Buhari regime established the Nigeria Economic Recovery & Growth Plan 2017-2020 (ERGP). The ERGP sets out three strategic goals to achieve economic recovery and growth: (1) growth recovery, (2) investment in Nigerian citizens, and (3) development of a globally competitive economy. Part of achieving number (3) (development of a globally competitive economy) will involve rectifying the problem of weak infrastructure which currently impedes Nigeria's economic competitiveness. The plan emphasizes the importance of investment in various types of infrastructure, including electric power, roads, railways, ports, internet (broadband), and others.

The ERGP cites the following five items as top priorities.

a) Stabilization of the macro-economic environment
b) Ensuring agriculture and food safety
c) Securing a stable and sufficient energy supply (electricity and petroleum products)
d) Improvement of transportation infrastructure
e) Promotion of industry with a focus on medium and small companies

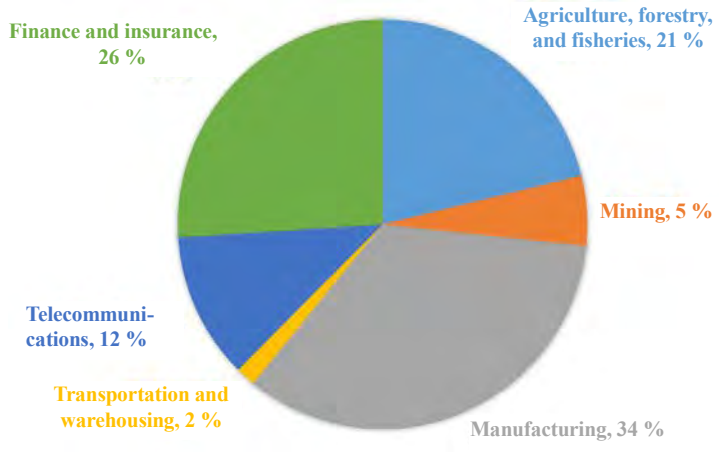
Of the above, number c) includes the goal of achieving an electric power supply capacity of 10 GW by the year 2020.

1-1-3 Socioeconomic Status

Nigeria comprises an area of 924,000 km^2, and has a population of 187 million people (2016 U.N. population white paper). The country is divided into two major characteristic climatic regions, the semiarid sub-Saharan region in the north, and the wetlands in the south. Nigeria is home to more than 250 different ethnic groups, and the national religious distribution is about 50 % Muslim, about 40 % Christian, and about 10 % indigenous

religions. The Islamic influence grows more prevalent further to the north. English is used as an official language.

Nigeria is the largest producer of oil in Africa, ranked as the 7th-highest oil producer among the members of OPEC (the Organization of Petroleum Exporting Countries). However, the price of crude oil has been falling since 2014, so in recent years, Nigeria's economic growth has stagnated, and in 2016, the country reported negative growth of -1.54 %. Figure 1-1-2 shows a breakdown of the 2016 nominal GDP as a relatively well-balanced industrial structure, with manufacturing accounting for the largest share at 34 %, followed by finance and insurance at 26 %, agriculture, forestry, and fisheries at 21 %, and other services at 19 %.



[Source] Nigerian National Statistics Office

Figure 1-1-2 Nominal GDP Breakdown by Industry (2016)

Table 1-1-3 shows Nigeria's economic indices, but as shown in Table 1-1-4, the goal of the national development plan "Nigeria Vision 20: 2020" is to achieve a minimum target nominal GDP of 900 billion USD by 2020, raising the per capita GDP to more than 4,000 USD, thereby improving the standard of living, and lifting Nigeria into the top 20 world economies. To achieve this goal, the Nigerian economy must grow 13.8 % per year[1] between 2009 and 2020, and while agriculture and industry will support the economy over the medium term, from 2018 and beyond, forecasts predict a transition to a mainly service-centered economy.

Table 1-1-3 Nigeria Socioeconomic Indices

Index	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Real GDP (1 billion Naira, base year: 2010)	37,475	39,996	42,922	46,013	49,856	55,469	58,180	60,670	63,943	67,977	69,781	68,705
Real GDP growth (%)	7.01	6.73	7.32	7.20	8.35	11.26	4.89	4.28	5.39	6.31	2.65	-1.54
Nominal GDP (1 billion Naira)	22,270	28,662	32,995	39,158	44,286	55,469	63,713	72,600	81,010	90,137	95,178	102,704
GDP per capita (USD)	1,245	1,591	1,823	2,234	1,959	2,365	2,583	2,798	3,042	3,268	2,763	2,211
Population (million people)	136	140	144	148	152	156	160	165	169	174	179	184

[Source] International Monetary Fund, World Economic Outlook Database, April, 2017

[1] As shown in table 1-1-4, GDP in the base year (2009) of Nigeria Vision20: 2020 is 212 billion USD. GDP growth rate per annum shall be 13.8 % ($1.138^{11} \times 2120 \fallingdotseq 9000$, for 11years of 2009 - 2020) in order for the GDP in 2020 to reach about 900 billion USD.

Table 1-1-4 National Development Plan (Nigeria Vision 20: 2020) Target Values

Item	Base	2015	2020
Nominal GDP	2,120 (100 M USD)	>4,000 (100 M USD)	>9,000 (100 M USD)
Economic structure (Agriculture : Industry : Service)	42.1 : 23.8 : 34.1	-	3-15 : 30-50 : 45-75
Agricultural productivity	2009	Threefold increase	Sixfold increase
Domestic refining capacity	445,000bpd	750,000bpd	1,500,000bpd
Ratio of non-oil contribution to foreign exchange	5:95	20:80	40:60
Industrial production contribution to GDP	<4 %	10 %	25 %
Spot goods	N/A	50 %	70 %
Private sector credit ratio of GDP	17 %	30 %	45 %
Steel consumption per capita	<10kg	40kg	100kg

[Source] Compiled by a collaborative preparatory survey group based on the Nigerian national development plan.

1-2 Grant Aid Background, Process and Outline

Lagos State is the center of Nigeria's economy, and currently experiencing rapid growth. It has a population of about 9 million people (source: 2006 national census), and is the country's largest port. Demand for electric power in Lagos State currently stands at 1,250 MW, but the average power supply is only 650 MW (source: Lagos State Electric Power Committee). Amid this dire power shortfall, forced power outages caused by grid overloads are a common occurrence throughout the state, and accidents causing grid-wide outages also occur due to lack of facilities maintenance. The Apapa Road substation in Lagos State supplies the power to the facilities, circumjacent industrial areas, private homes in the vicinity of Apapa, and port facilities including the Nigeria's largest port, Apapa port which handles 40 % of Nigeria's cargo imports (Source: National Bureau of Statistics). However, in addition to a lack of power generation capacity, this substation lacks sufficient transforming capacity, which causes insufficient power supply and inhibits port businesses and industrial activities. This means that an expansion of transforming capacity is urgently needed. Also, this substation has been in operation for 35 years and its gas insulated switchgear (hereinafter referred to as "132 kV GIS"), which functions to protect the grid and monitor the controllers, is aging. In 2012, the device broke down and stopped functioning. Therefore, there is an increasing risk that a short-out or other troubles in the emergency circuit breaker could cause major damage to grid facilities, which could lead to a prolonged blackout. A prolonged blackout would have a serious impact on the port and surrounding industries, so the 132 kV GIS facility must be restored as soon as possible.

In the national development plan "Nigeria Vision 20: 2020," the Nigerian government cites electric power and transport infrastructure installation as a top-priority issue. The Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substations (hereinafter referred to as "the Project") will increase transformer capacity and restore 132 kV GIS facilities, thereby improving the power distribution network. As such, it is positioned as a national development plan priority project.

Due to the circumstances detailed above, the Nigerian government has petitioned the Japanese government for aid in repairing the Apapa Road Substation in order to stabilize the supply of electric power to Lagos.

1-3 Trends in Japanese Support

To increase its diplomatic presence as an Economic Community of African States (ECOWAS) member state,

to contribute to the development of Nigeria as Africa's largest economy, and to strengthen its diplomatic ties with Nigeria and other countries in the region, Japan places high importance on maintaining its relationship with Nigeria from the perspective of contributing to energy resource security and supporting trade and investment for Japanese businesses. To that end, Japan has hammered out the following aid policy.

Basic Aid Policy (Major Goals) : Promote sustainable socioeconomic development

Fields of Focus (Mid-Level Goals) : a) Install basic infrastructure
b) Promote social development in urban centers

Of the above goals, "a) Install Basic Infrastructure" includes the goal of "contributing to the increase and stabilization of electric power supply, to remove the electric power bottleneck stifling the promotion of economic activity and investment," and plans are being formulated and implemented to provide comprehensive aid to the electric power sector. An "electric power development plan advisor" was dispatched between FY 2012 and FY 2013 to assist with strengthening the development platform for the electric power sector. Technical advice was offered on the development plans, and new plans were formulated. From FY 2015, the "Electric Power Master Plan Establishment Project" (scheduled between FY 2015 and FY 2017) has been offering capacity building support to the recipient government. In addition, plans are being formulated for large-scale power generation and distribution projects, largely in the form of yen loans. The policy focuses on increasing power generation capacity, and promoting a stable power supply.

1-3-1 Grant Aid (Electric Power Sector)

Grant aid collaboration with the Nigerian electric power sector was conducted in the form of regional power projects between 2000 and 2008 to establish a platform for sustainable socioeconomic development. These projects supported the achievement of the power goals set forth by the Nigerian government, establishing electric power networks in rural areas that previously had little access to electricity. An outline of past grant aid Projects are shown in Table 1-3-1.

Table 1-3-1 Japanese Electric Power Sector Grant Aid Project Outline

Project Name	E/N Date Signed	E/N Amount (100 M yen)	Target Regions
Regional Power Plan (period 1/3)	November 21st, 2000	12.00	Nasarawa State Bauchi State Gombe State Borno State
Regional Power Plan (period 2/3)	August 7th, 2001	6.53	
Regional Power Plan (period 3/3)	July 11th, 2002	16.28	
Regional Power Plan for Cross River and Akwa Ibom States (period 1/3)	June 22nd, 2006	9.32	Cross River State Akwa Ibom State
Regional Power Plan for Cross River and Akwa Ibom States (period 2/3)	August 16th, 2007	8.99	
Regional Power Plan for Cross River and Akwa Ibom States (period 3/3)	July 11th, 2008	5.74	
Jebba Hydroelectric Power Station Emergency Repair Plan	April 11th, 2011	19.90	Niger State
Clean Energy Introduction Plan Using Solar Energy	May 16th, 2012	9.80	Federal Capital Territory
Abuja Substation Facilities Emergency Repair Plan	February 11th, 2016	13.17	Federal Capital Territory,

Project Name	E/N Date Signed	E/N Amount (100 M yen)	Target Regions
			Nasarawa State

[Source] Ministry of Foreign Affairs home page, JICA Study Team

1-3-2 Technical Cooperation (Electric Power Sector)

Technical Cooperation Projects implemented in the Nigerian electric power sector up till the present are shown in Table 1-3-2 below.

Table 1-3-2 Technical Cooperation Projects Implemented with Japanese Aid

Year Implemented	Project Name	Project Outline
2004-2006	Solar Energy Use Master Plan Survey	Establish a solar power use master plan, and establish various proposals and directives to establish a policy to encourage the Nigerian government to use solar energy. Conduct capacity building at the organization which will bear the main responsibility for promoting solar energy use.
2012-2013	Electric Power Development Plan Advisor	Offer technical advice on new and existing plants as a counterpart institution to the Federal Power Ministry, while providing support for strengthening the Ministry's policy proposals and implementation capacity.
2015-2017 (currently being implemented)	Electric Power Master Plan Establishment Support Project	As a partner institution to FMPWH and TCN, establish a long-term electric power development plan, and support capacity building for counterparts.

[Source] JICA Study Team

1-4 Trends in Aid from Other Donors

Table 1-4-1 shows loans from various donors for investment in power distribution facilities. Funding from the African Development Bank and Euro Bonds was provided largely to make up for budgetary shortfalls in ongoing projects.

Table 1-4-1 Loans from Donors for Investment in Power Distribution Facilities

Funding Source	Amount ($1M USD)
African Development Bank: AfDB	100
(Economic and Power Sector Reform Program: EPSERP)	50
World Bank: WB	108
Nigeria Electricity and Gas Improvement Project: NEGIP	60
Euro Bond	136
Agence Française de Developpement: AFD	170
Total	624

[Source] Transmission Company of Nigeria (2014.3) "Appraisal of Transmission Projects"

In addition to the above, the World Bank also provided 485 million USD in financing for nationwide power distribution facilities repair. Lagos substations which are scheduled to be repaired using this funding are shown in Table 1-4-2.

Table 1-4-2 Outline of Substations in the Lagos Region Under Rehabilitation with World Bank Support

Power Plant Name	Component	Budget ($1M USD)
Ijora	Increase generator capacity (2 x 100 MVA) 132/33 kV substation equipment, facility rehabilitation	4.95
Lekki	1 x 300 MVA, 330/132 kV transformer 2 x 100 MVA, 132/33 kV transformer Rehabilitation of circuit breakers and peripheral equipment	4.95
Alagbon	1 x 300 MVA, 330/132 kV transformer 2 x 100 MVA, 132/33 kV transformer Rehabilitation of circuit breakers and peripheral equipment	9.46
Aja	1 x 150 MVA, 330/132 kV transformer 1 x 100 MVA, 132/33 kV transformer Complete renovation of GIS	13.20
Alausa	1 x 100 MVA, 132/33 kV transformer Rehabilitation of circuit breakers and peripheral equipment	2.42
Akoka	Complete renovation of GIS	7.7
Amowu Odofin	Complete renovation of GIS	7.7
Itire	Complete renovation of GIS	7.7
Otta	2 x 100 MVA, 132/33 kV transformer Rehabilitation of circuit breakers and peripheral equipment	4.455
Maryland	2 x 100 MVA, 132/33 kV transformer Rehabilitation of circuit breakers and peripheral equipment	4.95
Egbin	Replacement of controllers and protective panels, rehabilitation of control room, rehabilitation of circuit breakers and peripheral equipment	8.8

[Source] TCN

CHAPTER 2 CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Outline of the Project

2-1-1 Relationship with higher leveled Plan

In Nigeria Vision 20: 2020, a long-term national development plan, the government of Nigeria has focused especially on the power sector as priority areas among infrastructure industries necessary for further social and economic development. Moreover, also in Nigerian Economic Recovery and Growth Plan formulated by Buhari Administration, the necessity for investment to infrastructures mainly in power sector has been emphasized in order to achieve economic resurgence and growth.

The project aims to stabilize power supply to ports and industrial areas, and in the end, to contribute to the achievement of the above policy targets of the government of Nigeria by upgrading and enhancing Apapa Road Substation, which is located in Lagos, the largest commercial and port city in Nigeria.

2-1-2 Outline of the Project

The Project contributes to the stabilization of power supply by upgrading and enhancing the substation, and finally to the vitalization of social/economic activities.

The scope of the Project is to upgrade 132 kV/33 kV switchgears and enhance transformer capacities at Apapa Road Substation, which will become a hub of power supply to Apapa area in Lagos state where the power demand will be forecasted to grow largely.

2-2 Outline Design of the Project

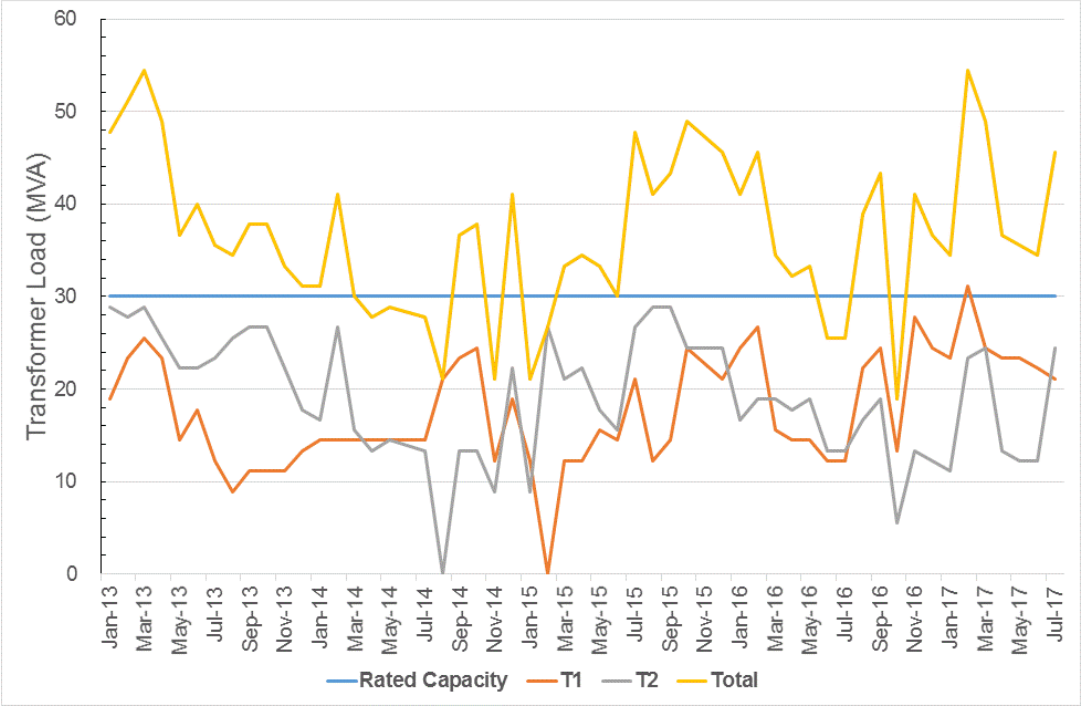
2-2-1 Design Policy

2-2-1-1 Basic Policy

The sizes and specifications of the equipment and materials procured in the Project should be selected under the consideration of power demand forecast, power system analysis, natural/social environment around the site and the operation and maintenance ability of the executing agency in Nigeria.

2-2-1-1-1 Forecast for Power Demand

The results of total loads of 2 transformers (TR 1 & TR 2) at Apapa Road Substation from January 2015 to July 2017 are shown Figure 2-2-1. In Nigeria the temperature is higher from January to April in dry season, and the power demand increases. On the other hand, the temperature is lower from June to September in wet season, and the power demand also decreases.

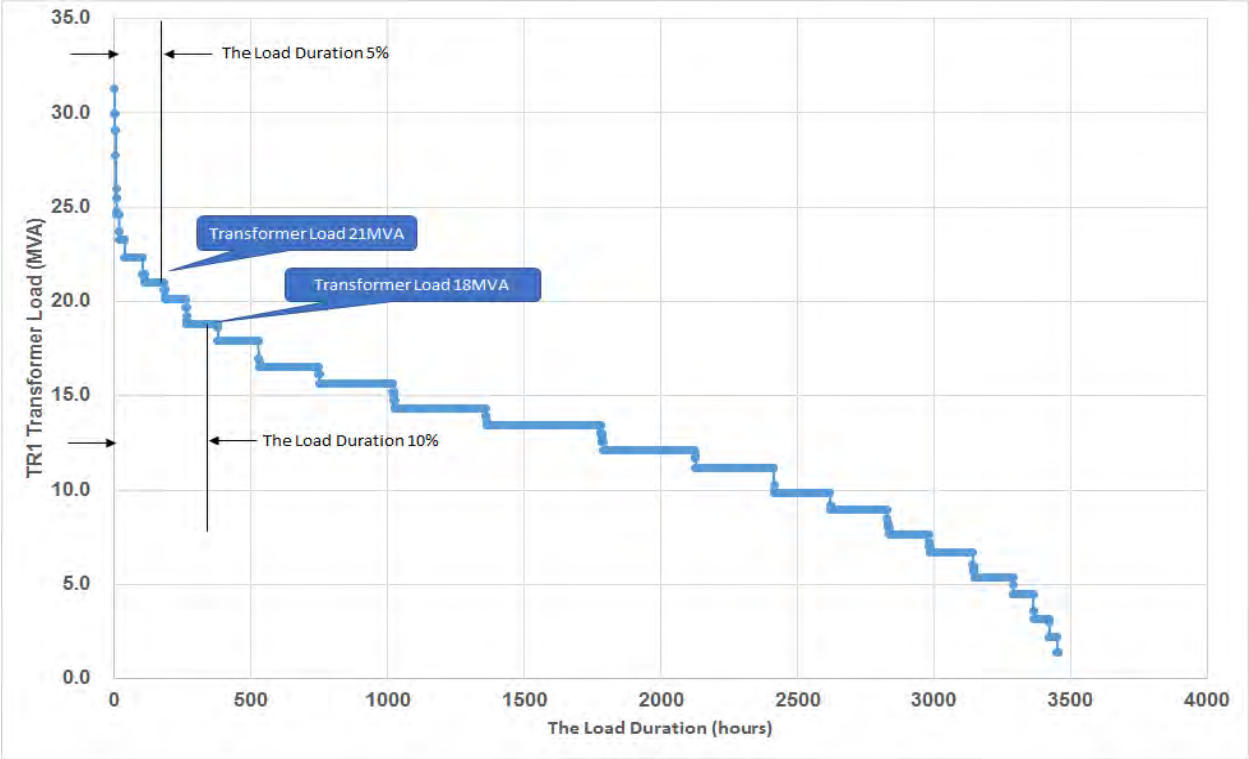


[Source] TCN

Figure 2-2-1 Results of Transformer Load of Apapa Road Substation (January, 2013-July, 2017)

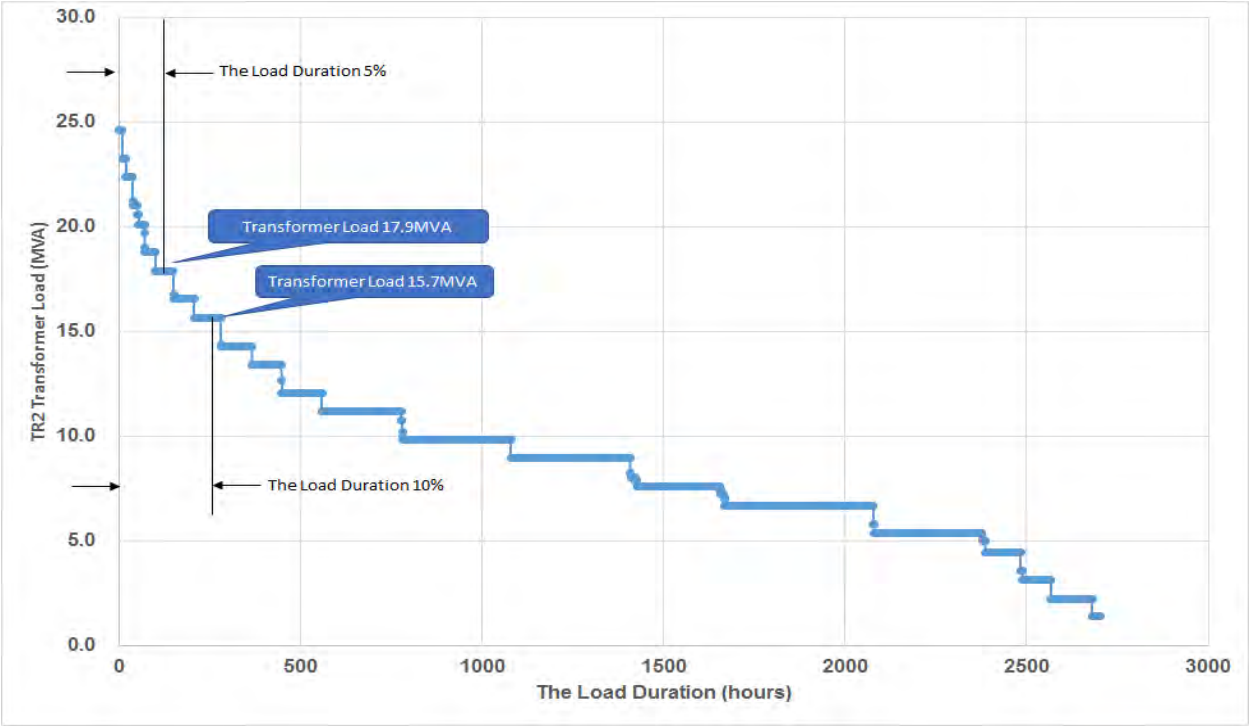
The load tendency is analyzed and recorded for each hour of each transformer of Apapa Road Substation (TR 1 & TR 2) during each period written below. Except specified period of stopping power supply due to power outage, each duration of each transformer load for each hour is recorded as graph arranged each data of each transformer load from big data to small data. Each transformer load of TR 1 and TR 2 is shown in the Figure 2-2-2 and the Figure 2-2-3.

1-December-2016 ~ 31-December-2016 (31 days)
1-January-2017 ~ 31-January-2017 (31 days)
1-February-2017 ~ 28-February-2017 (28 days)
1-March-2017 ~ 31-March-2017 (31 days)
1-April-2017 ~ 3-April-2017 (3 days)
5-June-2017 ~ 30-June-2017 (26 days)
1-July-2017 ~ 31-July-2017 (31 days)
1-August-2017 ~ 5-Augusut-2017 (5 days)



[Source] TCN

Figure 2-2-2 TR 1 Transformer Load



[Source] TCN

Figure 2-2-3 TR 2 Transformer Load

Total operation time except blackout time is 3,456 hours for TR 1 and 2,703 hours for TR 2 during operation period. Regarding TR 1, the specified period with transformer load more than 21 MVA is 5% of total operation time, and the specified period with transformer load more than 18 MVA is 10% of total operation time. While, regarding TR 2, the specified period with transformer load more than 17.9 MVA is 5% of total operation time, and the specified period with transformer load more than 15.7 MVA is 10% of total operation time.

The maximum load during operation period of TR 1 is 31.3 MVA, the period with transformer load more than 30 MVA is 0.09% of total operation time. While, the maximum load during operation period of TR 2 is 24.6 MVA, the period with 24.6 MVA transformer load is 0.3% period of total operation time. There is very short period with the maximum transformer load of both TR 1 and TR 2, 95% of TR 1 period is the period with less than 67% of the maximum load, and 95% of TR 2 period is the period with less than 73% of the maximum load.

In "the Project for Master Plan Study on National Power System Development in the Federal Republic of Nigeria" by JICA (hereinafter referred to as JICA Master Plan), the growth rate of peak power by distribution companies is forecasted as shown as Table 2-2-1. In the Project, the future demand will be forecasted based on the growth rate of Ikeja/EKO distribution companies in the table below.

Table 2-2-1 Growth Rate of Peak Power by Distribution Companies

	Disco	2020/15	2025/20	2030/25	2035/30	2040/35	2040/15
1	Abuja	12.7	17.5	11.8	8.9	8.3	11.8
2	Benin	7.6	8.6	7	4.2	3.7	6.2
3	Enugu	6.6	7	4.4	1.7	1.2	4.1
4	Ibadan	9.5	10	8.3	5.5	5	7.7
5	Ikeja+EKO	7.8	6.1	6.7	3.9	3.3	5.5
6	Jos	7.9	10.2	10.8	1.9	1.4	6.4
7	Kaduna	8.7	13.5	14.1	5.2	4.7	9.2
8	Kano	11.3	12.7	13.4	10.5	6.3	10.8
9	P/H	9.1	11.5	7.2	4.4	3.8	7.2
10	Yola	9	12.4	13.1	10.1	3.5	9.6
	Country	8.8	10.2	9.1	6	5	7.8

[Source] The Project for Master Plan Study on National Power System Development (Interim Report) by JICA

There are general consumers and commercial & industrial consumers (including ports) which receive power from distribution systems, and also industrial consumers such as factories with non-utility generators around the Apapa Road Substation. The industrial consumers with non-utility generators demand higher reliability in power supply because the shutdown of production lines due to blackout may cause large damages. The reliability of power supply from Apapa Road Substation will be forecasted to become improved by the upgrade of the substation. However, in order to achieve the high-level reliability which industrial consumers demand, the improvement of upstream power supply system of the substation will become necessary, and certain time will be needed to achieve this result. Moreover, large industrial consumers generate electricity for themselves through their own installed dedicated gas pipelines, and it is assumed that their costs are comparable to those in receiving power from the power system[1].

[1] Fuel cost for generation was 23 to 27 Naira/kWh as the result of hearing of industrial consumers who generating electricity by gas. The rate of electricity for industrial consumers of Eko distribution company is 24 to 36 Naira/kWh. (as of August, 2017)

Therefore, it will be lower possible for self-generation consumers to switch to the receipt of power from the power system in the near future, so the power demand of Apapa Road Substation which is used in planning the Project should be set as the power demand of general consumers and commercial & industrial consumers except self-generation consumers.

Table 2-2-2 shows future load forecast of the substation based on the maximum load record of Apapa Road Substation, and Table 2-2-3 shows future load forecast of the substation based on the maximum load record except 5% high load of total load duration. The installed capacity should basically be planned so as not to be insufficient for the maximum load, but as mentioned above, the specified period with the maximum load is very short to the total operation time, so based on the future load forecast of "the maximum load record except 5% high load of total load duration" shown in Table 2-2-2, the updated installed capacity of transformers will be selected.

The life span of transformer is generally 20 to 30 years, and it is general that the load rate becomes mostly 100% at the middle stage of life span of equipment, and that the subsequent increase of power demand is dealt by means of the expansion of new equipment. Table 2-2-3 shows that substation load is expected to reach 97 MVA in 2031, 10 years after the completion of this project in 2021, and it also shows that expansion of new transformers will be necessary in 2030, 8 years after the completion of the Project, in case of the first requested installed capacity of 45 MVA/each x 2 transformers. This implies that the period reaching 100% load rate is very short in lifecycle of equipment, it is hopeful to improve installed capacity to 60 MVA.

Table 2-2-2 Future Load Forecast of Apapa Road Substation

(Based on the Maximum Load Record)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
(1) Domestic+Industry (MW)	49	53	57	61	65	69	73	78	83	88	94	100	107	114	122	130
(2) Domestic+Industry (MVA)	54	59	63	68	72	77	81	86	92	98	104	111	119	127	135	144
(3) Captive generator users (MW)	60	65	70	75	80	85	90	95	101	108	115	123	131	140	149	159
(4) Captive generator users (MVA)	71	76	82	88	94	100	106	112	119	127	135	144	154	164	175	187
(5) Total (MW) (1)+(3)	109	118	127	137	145	154	163	173	184	196	209	223	238	254	271	289
(6) Total (MVA) (2)+(4)	125	135	145	157	166	176	187	198	211	225	240	256	273	291	311	332
Growth rate (%)	7.8	7.8	7.8	7.8	6.1	6.1	6.1	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Power factor (Domestic+Industry)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Power factor (Captive generator users)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

[Source] JICA Mission

Table 2-2-3 Future Load Forecast of Apapa Road Substation

(Based on the Maximum Load Record except 5% High Load of total Load Duration)

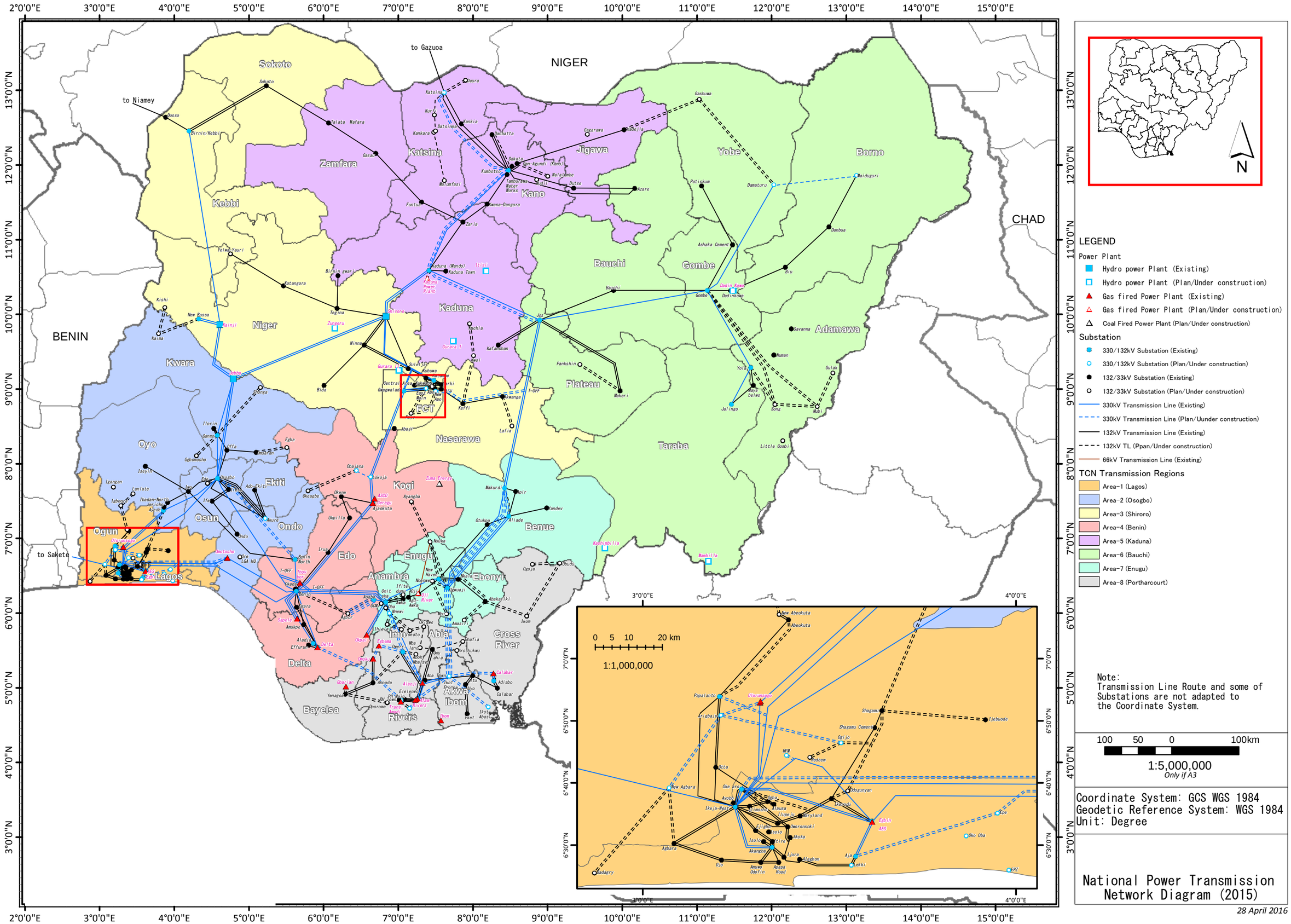
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
(1) Domestic+Industry (MW)	35	38	41	44	47	49	52	56	59	63	67	72	76	82	87	93
(2) Domestic+Industry (MVA)	39	42	45	49	52	55	58	62	66	70	75	80	85	91	97	103
(3) Captive generator users (MW)	60	65	70	75	80	85	90	95	101	108	115	123	131	140	149	159
(4) Captive generator users (MVA)	71	76	82	88	94	100	106	112	119	127	135	144	154	164	175	187
(5) Total (MW) (1)+(3)	95	102	110	119	126	134	142	151	160	171	182	194	207	221	236	252
(6) Total (MVA) (2)+(4)	109	118	127	137	146	154	164	174	184	197	210	224	239	255	272	290
Growth rate (%)	7.8	7.8	7.8	7.8	6.1	6.1	6.1	6.1	6.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Power factor(Domestic+Industry)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Power factor(Captive generator users)	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

[Source] JICA Mission

2-2-1-1-2 Network Analysis

(1) Netwok System

The power network system in Nigeria is shown in Figure 2-2-4. 330 kV network configures the bulk power network interconnecting area networks mutually, and 132 kV network plays a role to supply power locally.



[Source] TCN

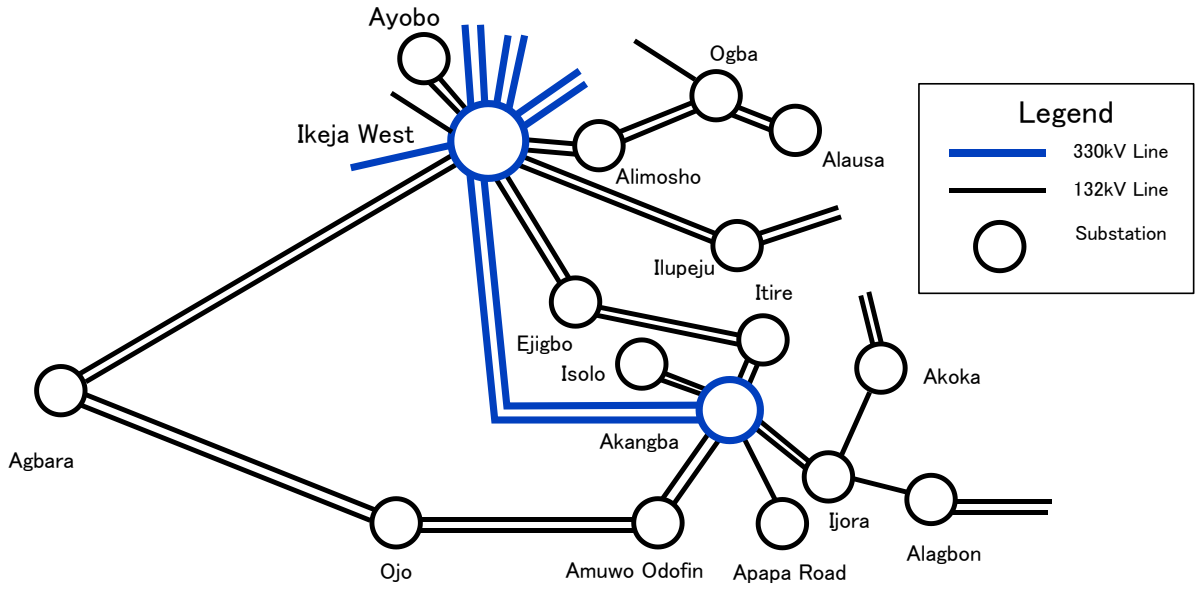
Figure 2-2-4 Power network system in Nigeria

The power demand in Lagos State is 70 % of the total demand in the country, and Figure 2-2-5 shows the main grid in Lagos network.

Apapa Road Substation which is the project site supplies the power to port facilities in Apapa port as the largest port in Nigeria, and to non-industrial loads like commercial and residential.

The power flows are shown below.

The power upgathered from power stations around the country to Ikeja-West Substation which is the major substation is transmitted to 330/132 kV Akangba Substation through 330 kV Ikaja-West-Akangba line. The voltage is stepped down there to 132 kV, and the power is transmitted to Apapa Road Substation through 132 kV Akangba-Apapa Road line.



[Source] Network analysis data provided by TCN

Figure 2-2-5 Major network in Lagos

(2) Facilities

The transmission lines and substation facilities in Lagos network are shown in Table 2-2-4 and Table 2-2-5 respectively.

Table 2-2-4 Transmission lines in Lagos network

From	To	Length (km)	No. of Circuit	Condu-ctor	No. of Conductor	Cross Section (mm^2)	Capacity (MVA)
330 kV							
Benin	Egbin	218	1	Bison	2	$350mm^2$	777
Egbin	Ikeja West	62	1	Bison	2	$350mm^2$	777
Benin	Omotosho	120	1	Bison	2	$350mm^2$	777
Omotosho	Ikeja West	160	1	Bison	2	$350mm^2$	777
Egbin	Oke Aro	55.8	2	Bison	2	$350mm^2$	1554

From	To	Length (km)	No. of Circuit	Condu-ctor	No. of Conductor	Cross Section (mm^2)	Capacity (MVA)
Oke Aro	Ikeja West	27.9	2	Bison	2	$350mm^2$	1554
Egbin	Aja	15	2	Bison	2	$350mm^2$	1554
Ikeja West	Akangba	17.34	1	Bison	2	$350mm^2$	777
Osogbo	Ikeja West	256.67	1	Bison	2	$350mm^2$	777
Ikeja West	Olorunsogo	77	1	Bison	2	$350mm^2$	777
Olorunsogo	Ayede	60	1	Bison	2	$350mm^2$	777
Ayede	Osogbo	119	1	Bison	2	$350mm^2$	777
132 kV							
Aja	Alagbon	26	2	Bear	2	$250mm^2$	242
Ikeja West	Oworonshiki	49	2	Bear	1	$250mm^2$	242
Oworonshiki	Akoka	4	2	Bear	1	$250mm^2$	242
Akoka	Alagbon	12.7	2	Bear	1	$250mm^2$	242
Akangba	Amuwo	5	2	Bear	1	$250mm^2$	242
Amuwo	Ojo	12.5	2	Bear	1	$250mm^2$	242
Akangba	Apapa Road	8.3	2	Wolf	2	$150mm^2$	180
Ijora	Akangba	8.3	2	Wolf	2	$150mm^2$	180
Ayede	Shagamu	53.91	1	Wolf	1	$150mm^2$	90
Shagamu	Ijebu Ode	40.32	1	Bear	1	$250mm^2$	121
Ogba	Papalanto	44.28	1	Wolf	1	$150mm^2$	90
Ikeja West	Agbara	32.04	2	Bear	1	$250mm^2$	242
Ikeja West	Alimosho	18.36	2	Bear	1	$250mm^2$	242
Ikeja West	Ejigbo	13.32	2	Bear	1	$250mm^2$	242
Ikeja West	Otta	11.88	2	Bear	1	$250mm^2$	242
Otta	Papalanto	11.88	2	Bear	1	$250mm^2$	242
Egbin GS	Ikorodu	19.96	2	Bear	1	$250mm^2$	242
Ikorodu	Egbin	19.5	2	Bear	1	$250mm^2$	242
Ikorodu	Shagamu	35.16	1	Wolf	1	$250mm^2$	180
Agbara	Ojo	16.37	1	Bear	1	$250mm^2$	121
Akangba	Itire	3	2	Bear	1	$250mm^2$	242
Itire	Ejigbo	8	2	Bear	1	$250mm^2$	242
Ejigbo	Ikeja West	13	2	Bear	1	$250mm^2$	242
Akangba	Isolo	9	2	Wolf	1	$150mm^2$	180
Ikeja West	Ilupeju,	17	2	Bear	1	$250mm^2$	242
Ilupeju	Maryland	3	2	Wolf	1	$250mm^2$	180
Maryland	Ikorodu	20	2	Bear	1	$250mm^2$	242
Papalanto	Abeokuta	35	1	Bear	1	$250mm^2$	121
Alimosho	Ogba	19	2	Bear	1	$250mm^2$	242
Ayede	Jericho	2	1	Wolf	1	$150mm^2$	90
Ogba	Alausa	7.5	2	Bear	1	$250mm^2$	242
Osogbo	Ilorin	78.46	1	Wolf	1	$150mm^2$	90
Osogbo	Omuaran	47.53	1	Wolf	1	$150mm^2$	90
Osogbo	Ayede	37.15	1	Bear	1	$250mm^2$	121
Osogbo	Ife	33.13	1	Wolf	1	$150mm^2$	90
Ife	Ondo	58.05	1	Wolf	1	$150mm^2$	90
Osogbo	Ilesa	16.4	1	Wolf	1	$150mm^2$	90
Osogbo	Akure	95	1	Wolf	1	$150mm^2$	90

[Source] TCN

Table 2-2-5 Substation facilities in Lagos network

Substation	Rating (MVA)	Voltage (kV)	Substation	Rating (MVA)	Voltage (kV)
Aja	150	330/132/33	Oworon-shoki	60	132/33
	150	330/132/33		60	132/33
	150	330/132/33	Alagbon	66	132/33
	100	132/33		66	132/33
	60/40/20	132/33	Apapa Road	45/30/15	132/33
	20	132/11		45/30/15	132/33
	60	132/33	Akoka	45/30/15	132/33
Akangba	90	330/132/13.8		40	132/33
	90	330/132/13.8	Amuwo-Odofin	60	132/33
	90	330/132/13.8		30	132/33
	150	330/132/33		40	132/33
	60	132/33		40	132/34
	60	132/33	Lekki	60	132/33
	60	132/33		60	132/34
	90	330/132/13.8	Ogba	60/40/20	132/33
	150	330/132/33		60	132/33
Egbin	150	330/132		60	132/33
	150	330/132		45/30/20	132/33
Ekeja-West	150	330/132/33		20	132/11
	150	330/132/33	Alimosho	30	132/33
	150	330/132/33		60	132/33
	150	330/132/33		30	132/33
	150	330/132/33	Ejigbo	30	132/33
	150	330/132/33		30	132/33
Akangba	40	132/33		100	132/33
	40	132/33			
Ilupju	15	132/11	Agbara	45/30/15	132/33
	45/30/15	132/33/11		45/30/15	132/33
	15	132/11		60	132/33
	30	132/33			
Ijora	30	132/33	Alausa	45/30/15	132/33
	30	132/33		30	132/33
	45/30/15	132/33/11		60	132/33
	30	132/33	Otta	40	132/33
Ojo	30	132/33		60	132/33
	60	132/33		30	132/33
	60	132/33		40/30/20	132/33
Isolo	60	132/33	Papalanto	15	132/33
	60	132/33		15	132/33
	45/30/15	132/33		30	132/33
Itire	30	132/33	Ayobo	60	132/33
	60	132/33		60	132/34
	40	132/33	Oke-Aro	300	330/132/33
Maryland	22.5/30	132/33		300	330/132/33
	60	132/33		60	132/33
	30	132/33		60	132/33
Ikorodu	60	132/33	Sagamu	30	132/33
	60	132/33		30	132/33
	100	132/33			

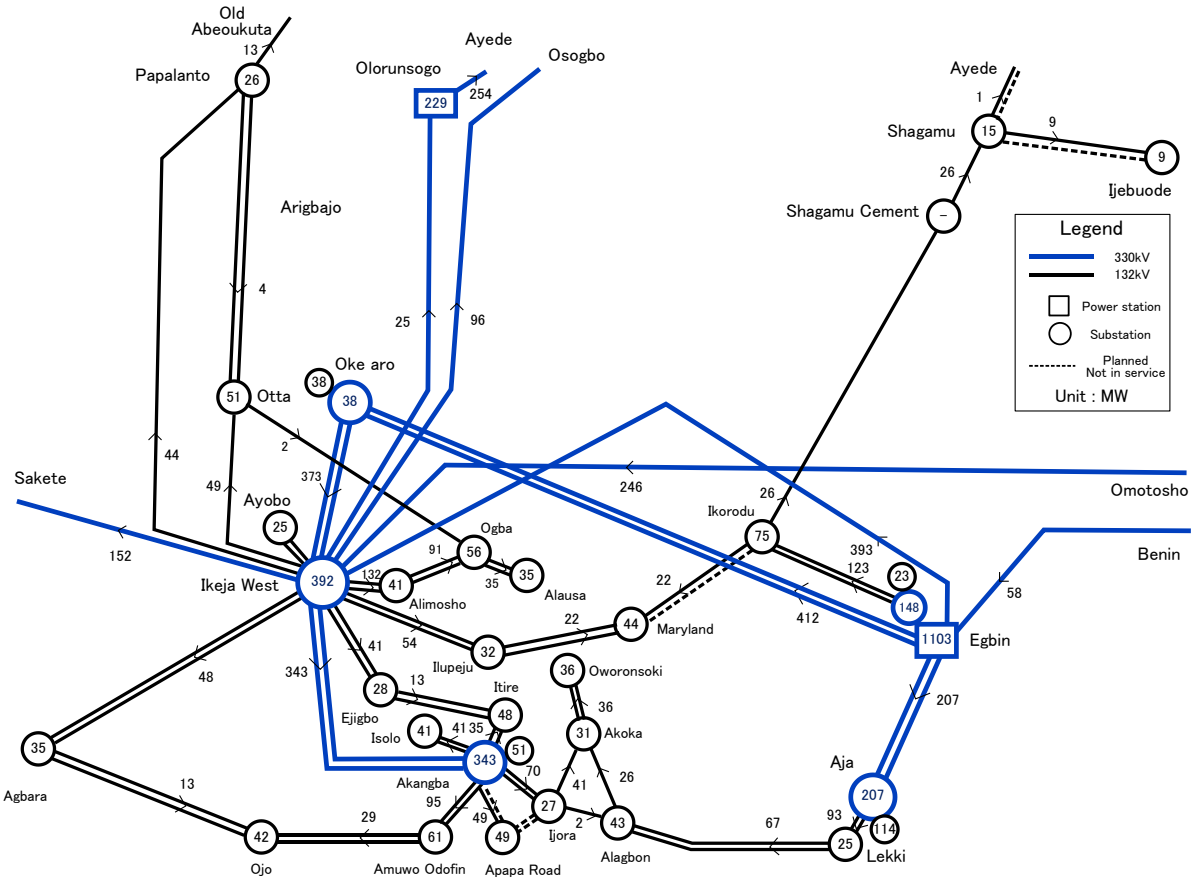
[Source] TCN

(3) Network Analysis result for existing network

1) Voltage and Power flow

Based on the network analysis data provided by TCN on February 2017 which reflects the actual demand record in 2016, reflecting maximum demand 49 MW recorded in Apapa Road Substation on February 2017 and correcting some errors, the data to analyze the network of the year 2017 is created. This data simulates the whole network in Nigeria and the simulated total demand is 4,580 MW.

The power flow analysis result is shown in Figure 2-2-6.



[Source] JICA Study Team

Figure 2-2-6 Power flow analysis result for existing network

The maximum power flows per one circuit in 330kV and 132 kV lines are 393 MW in 330 kV Egbin-Ikeja West line and 66 MW in Ikeja West-Alimosho line respectively. The both values are much less than transmitting capacities (330 kV 699 MW, 132 kV 112 MW, power factor 0.9 assumed), therefore, no overloading problem exists.

The power to Apapa Road Substation is supplied from 330 kV Akangba Substation through 132 kV Akangba-Apapa Road of length 8.3 km. This line has two circuits, however, only one circuit is in anomalistic operation by T-shape branching from Akangba-Amuo Odofin line at Akangba

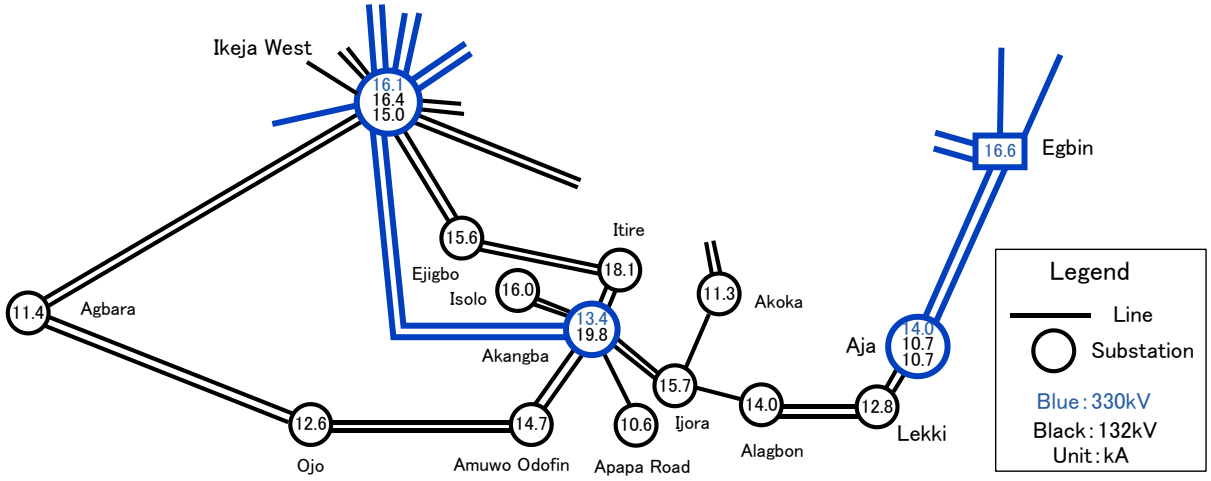
Substation. Since the power flow in this line is small and the length of this line is short, the voltage drop is small (128.0 kV at Akangba as a sending end, 126.9 kV at Apapa Road as a receiving end), whose voltages are within the values from 85 % to 110 % stipulated in the Grid Code.

2) Fault Current

The fault current analysis result around Apapa Road Substation in Lagos network is shown in Figure 2-2-7.

The maximum value in 330 kV is 16.6 kA at Egbin Power Station and the value at Akangba Substation as a sending end to Apapa Road Substation is 13.4kA, the both values are less than the circuit breaker rating 31.5 kA, no problem exits.

The maximum value in 132 kV is 19.8 kA at Akangba Substation, and the value at Apapa Road Substation is 10.6 kA, they are also less than the rating 40 kA of the existing circuit breakers in both stations.



[Source] JICA Study Team

Figure 2-2-7 Current condition of fault current in Lagos network

(4) Network in 2021

1) Demand

Since Apapa Road Substation is expected to be completed in 2021, the years of 2021 and 2025 as target years for network analysis are set. According to the Master Plan developed by World Bank, the demand is forecasted 11 GW in 2021 and 15 GW in 2025 under the medium growth rate. On the other hand, 10.872 GW in 2021 and 21.674 GW in 2025 are forecasted in JICA Master Plan, in which, because of improvement of the status of the power supply, the latent demand will become obvious in the latter half of the decade, therefore, the demand growth rate in the period from 2021 to 2025 is high 18.8 %.

However, the hearing investigation conducted this time to factories installing private power generator makes clear that the factories will depend on the power generated by the own generators

not the grid power until the problem of chronic blackout will be solved and the power will be supplied stably. Since the current situation of power shortage and low transmission capability of network are not expected to be improved, the Survey Team assumed that the latent demand will exist in the latter half of the decade. Therefore, the network analysis is implemented under condition of demand whose growth rate are described in Chapter 2-2-1-1-1, and the total demand in 2021 and 2025 is 10.0 GW and 14.6 GW respectively. And regarding power factor in each substation, the actual value recorded in 2017 is adopted.

2) Voltage and Power Flow

Based on the data (total demand 10,092 MW) provided by TCN on February 2017, correcting errors and renewing the demand and network configuration and so on, the network analysis data is created.

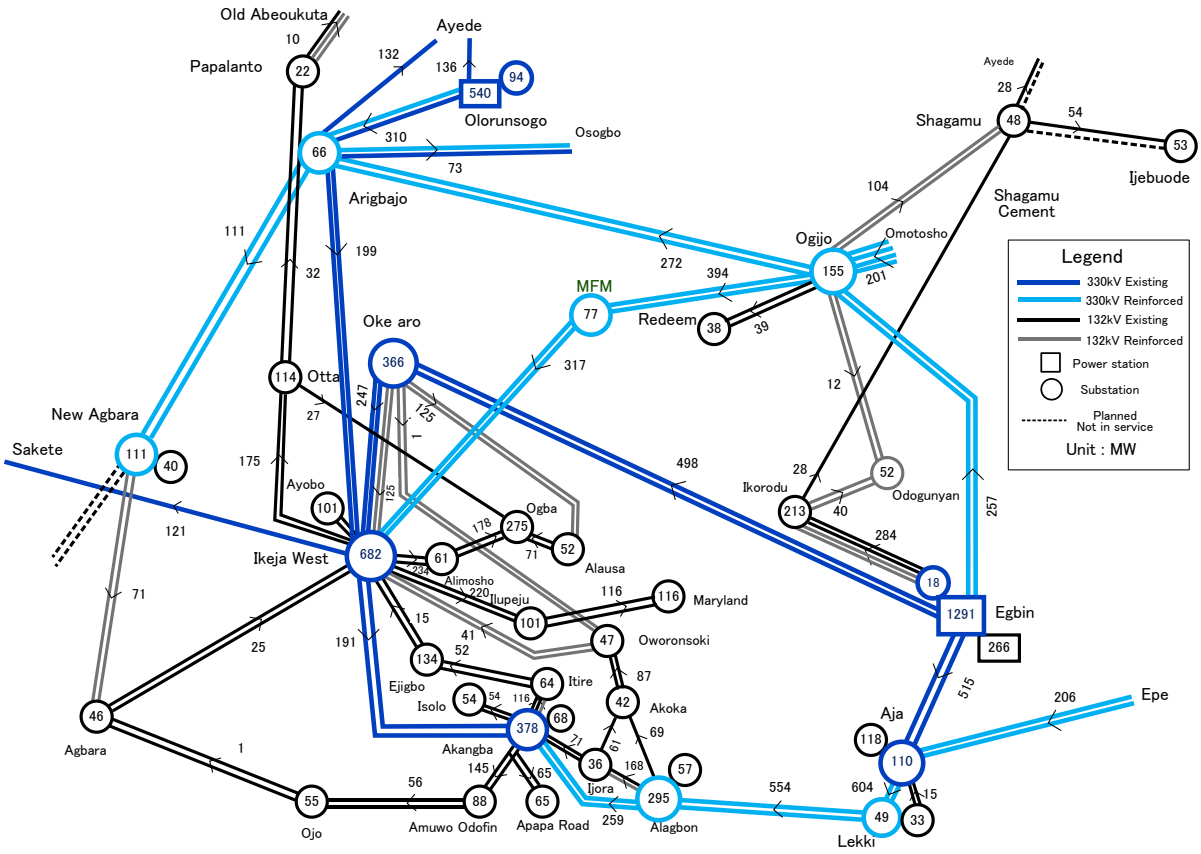
The power flow analysis result is shown in Figure 2-2-8. In this figure, dark-color and light-color indicate the existing facilities as of 2017 and the facilities to be developed from 2017 to 2021 respectively.

Comparing this figure and Figure 2-2-6 follows below results.

Apapa Road Substation is connected to a double circuit line branched T-shape from Akangba-Amuwo Odofin line. In accordance with network scale increase, 330 kV network expands, especially, the completion of 330 kV Aja-Lekki-Alagbon-Akangba line composes the circular network entirely around Lagos area.

The maximum power flow in 330 kV network is 604 MW in Aja-Lekki line, this value is below transmitting capacity per circuit (continuously 777 MVA, short time 855 MVA), then, no overloading problem exists even under single contingency (N-1) condition.

The maximum power flow in 132 kV network around Apapa Road is 145 MW in Akangba-Amuwo Odofin line (138MVA of short time transmitting capacity per circuit), because it decreases to 126 MW under contingency condition, no overloading problem exist.

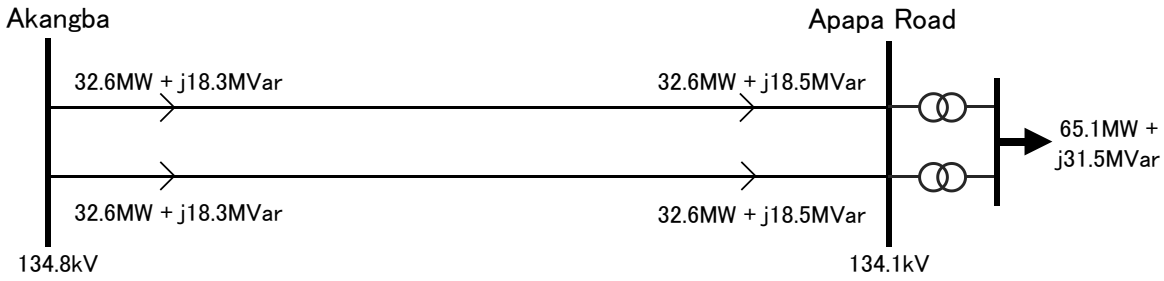


[Source] JICA Study Team

Figure 2-2-8 Power flow analysis result in 2021

Figure 2-2-9 shows the voltage condition of Akangba-Apapa Road line. It is assumed that the power factor of the load in Apapa Road Substation is 0.9 same as the present condition and the existing capacitor bank will be removed.

No overloading exists because of the transmitting capacity per circuit 90 MVA, and the voltage drop between Akangba and Apapa Road is small 0.7 kV. This proves that the appropriate voltage at Apapa Road can be maintained if the voltage in Akangba Substation is appropriate. Therefore, it can be said that installing capacitors in Apapa Road Substation is not required.



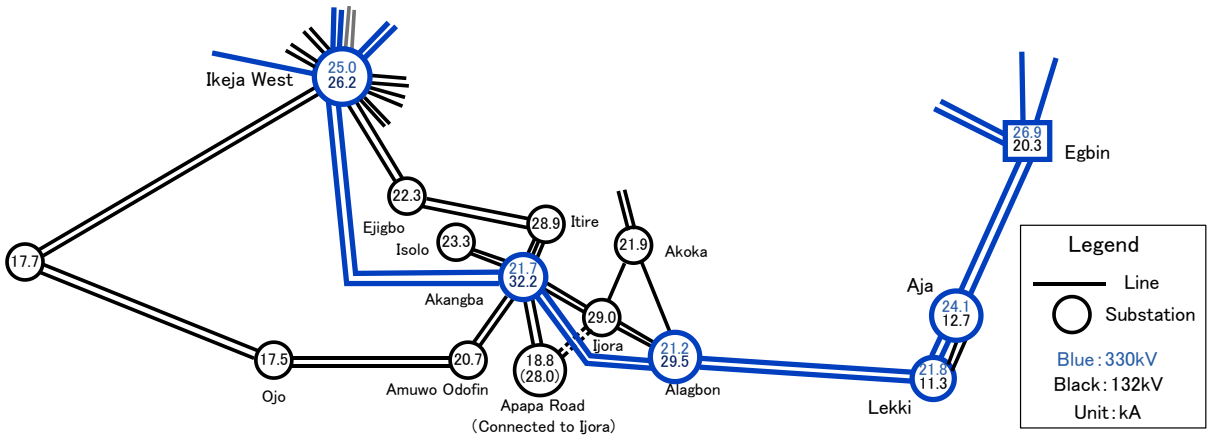
[Source] JICA Study Team

Figure 2-2-9 Voltage condition of Akangba-Apapa Road line

3) Fault current

Figure 2-2-10 shows the fault current analysis result around Apapa Road Substation. The fault currents in 132 kV are 32.2 kA at Akangba and 18.8 kA at Apapa Road. Apapa Road-Ijora line is nearly completed in 2017, however, the difficulty of acquiring land makes the completion delay.

Assuming that the line is completed until 2021 and Apapa Road Substation is interconnected to Akangba Substation and Ijora Substation, the fault current in Apapa Road Substation will be 28.0 kA.



[Source] JICA Study Team

Figure 2-2-10 Fault current analysis result around Apapa Road Substation

4) Stability

The study condition for stability is set that 3 phase short circuit fault in one circuit occurs in double circuit line and 80 ms after, the circuit breakers work to open the faulted circuit, this is stipulated in Grid Code.

Besides, taking a margin into account, 100 ms of fault clearing time for 132 kV transmission line is adopted

Since this project targets at Apapa Road Substation, faults adjacent there are selected for stability analysis. The stability analysis condition is shown in Table 2-2-6.

Table 2-2-6 Stability analysis condition

Voltage	Faulted point	Line opened	Fault clearing time	Case No.
330 kV	Nearest point from Akangba 330 kV bus	330 kV Akangba-Ikeja West	80 ms	1
		330 kV Akangba-Alagbon	80 ms	2
132 kV	Nearest point from Akangba 132 kV bus	132 kV Akangba-Apapa Road	100 ms	3

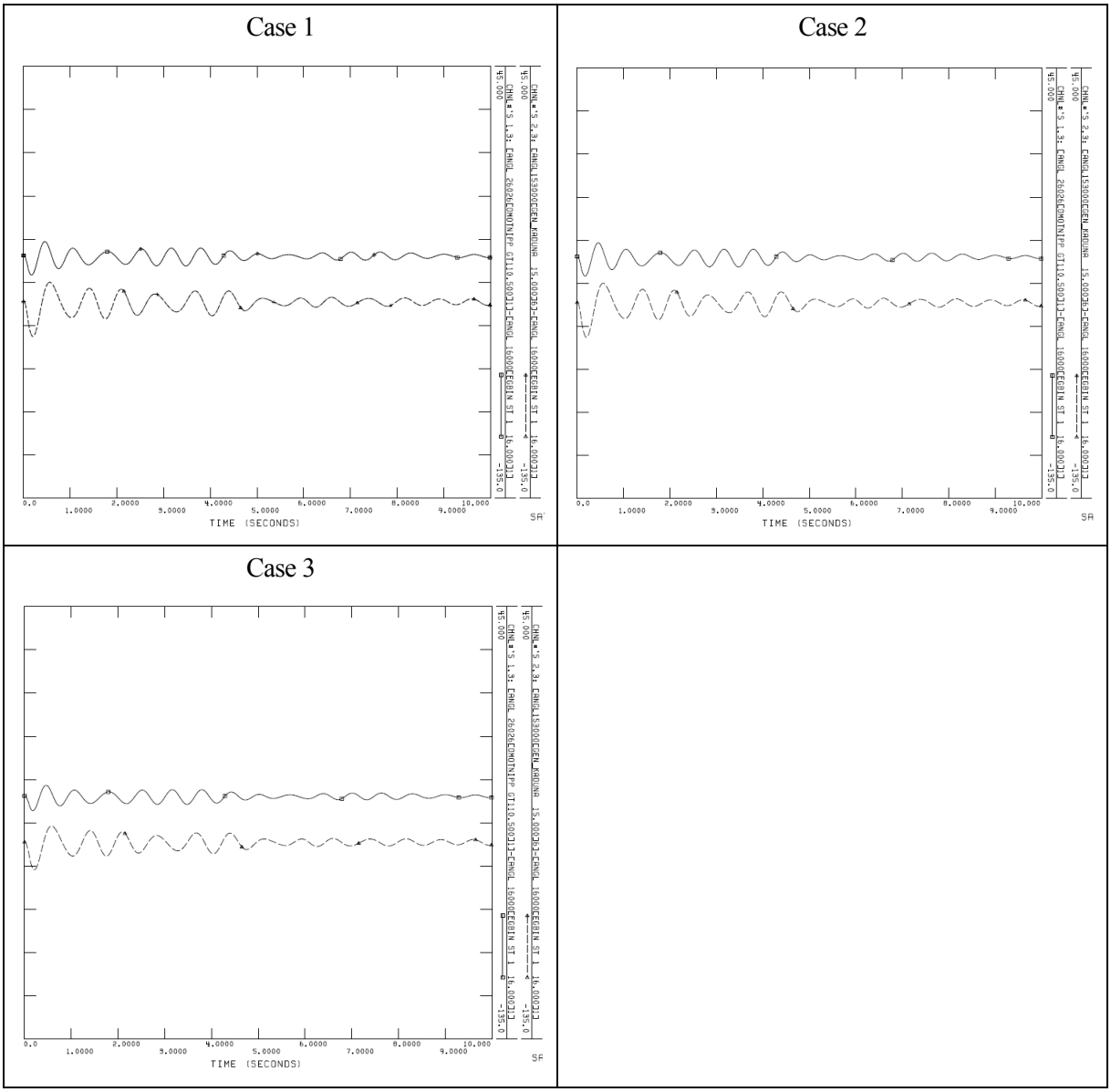
[Source] JICA Survey Team

The stability analysis result is shown in Figure 2-2-11. In this table, a fluctuation of generator

voltage angle after a fault occurrence is described. The time sequence is as follows.

3-phase short circuit fault occurs at 0 ms, the fault is cleared and faulted circuit is opened at 80 ms for 330 kV and at 100 ms for 132 kV.

The stability analysis result indicates that the fluctuation of generator decreases with time and converges, the network can operate stably after a severe fault occurring in all cases.



[Source] JICA Study Team

Figure 2-2-11 Stability analysis result

(5) Network in 2025

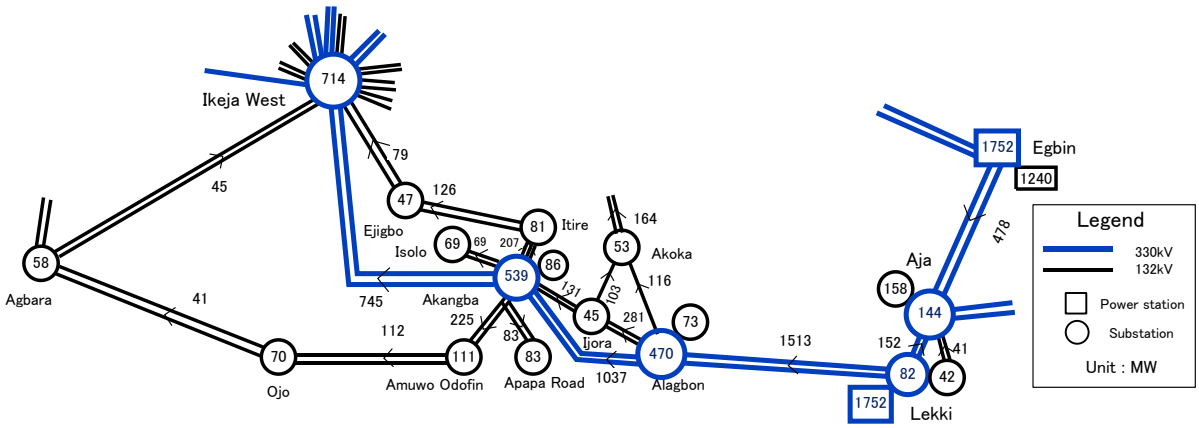
Assuming the latent demand exists in 2025 and the total demand is 14.6 GW, the network analysis is implemented.

The load in each substation is forecasted in manner that the load will increase uniformly at a rate of nationwide average 10.2 % from 2021 to 2025 described in Chapter 2-2-1-1-1. The network configuration in 2025 is assumed same as in 2021. Egbin and Lekki are selected from candidate sites as the power development corresponding to demand growth 4.6 GW, and the output of each power station is total 1,752 MW (292 MW per unit, 6 units)..

1) Voltage and Power Flow

The power flow analysis result around Apapa Road Substation is shown in Figure 2-2-12.

The maximum power flow in 330 kV network is 1,513 MW in Lekki-Alagbon line, since Egbin and Lekki near Apapa Road are selected as a power development. The maximum power flow in 132 kV network is 281 MW in Alagbon-Ijora line (transmitting capacity per circuit 330 MVA),



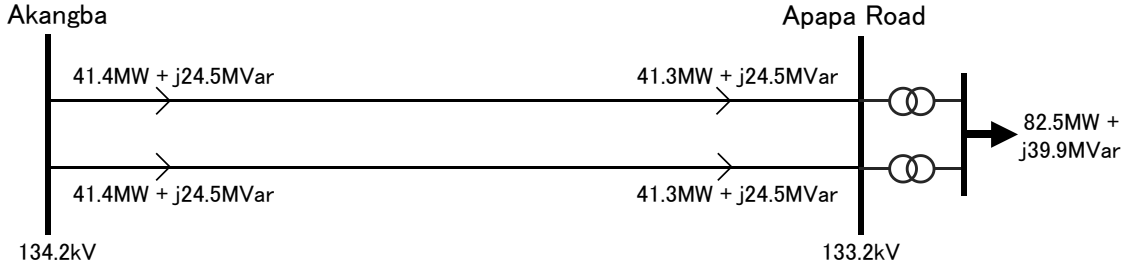
[Source] JICA Survey Team

Figure 2-2-12 The power flow analysis result around Apapa Road in 2025

Figure 2-2-13 shows the voltage condition of Akangba-Apapa Road line.

No overloading under normal condition exists because of the continuous transmitting capacity per circuit 90 MVA. Under single contingency condition, the active power 82.8 MW and reactive power 49.0 MVar i.e. apparent power 96.2 MVA flow, no overloading exists, since this value is below short time capacity 99 MVA.

The voltage drop between Akangba and Apapa Road is small 1.0 kV. This proves that the appropriate voltage can be maintained if the voltage in Akangba Substation is appropriate.

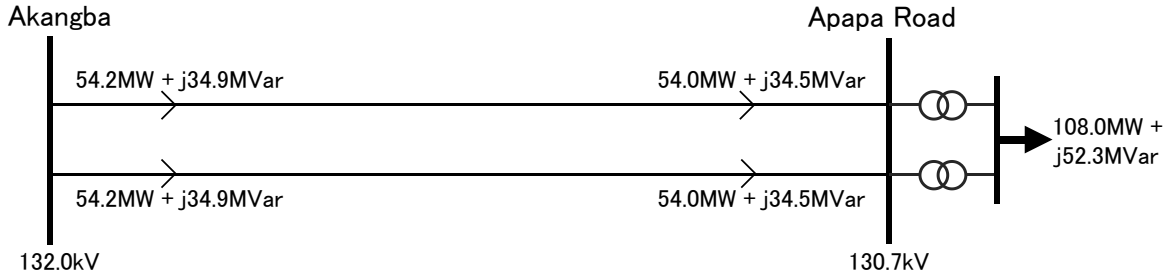


[Source] JICA Study Team

Figure 2-2-13 Voltage condition of Akangba-Apapa Road line

The case that the load reaches the transformer capacity (2 units of 60 MVA) in future is studied, the voltage and power flow are shown in Figure 2-2-14. The power flow in Akangba-Apapa Road line is 108.4 MW of active power and 69.8 MVar of reactive power (128.9MVA of apparent power), this value is greater than transmitting capacity under contingency condition, hence measures against a overloading such as reconductoring is required.

When the voltage at Akangba Substation as a sending end is 132 kV, the voltage at Apapa Road Substation is 130.7 kV, the voltage drop is small 1.3 kV. This proves that the appropriate voltage can be maintained if the voltage in Akangba Substation is appropriate. Therefore, it shows that installing capacitors in Apapa Road Substation is not required in the future.



[Source] JICA Study Team

Figure 2-2-14 Voltage and power flow of Akangba-Apapa Road line for ultimate load at Apapa Substation

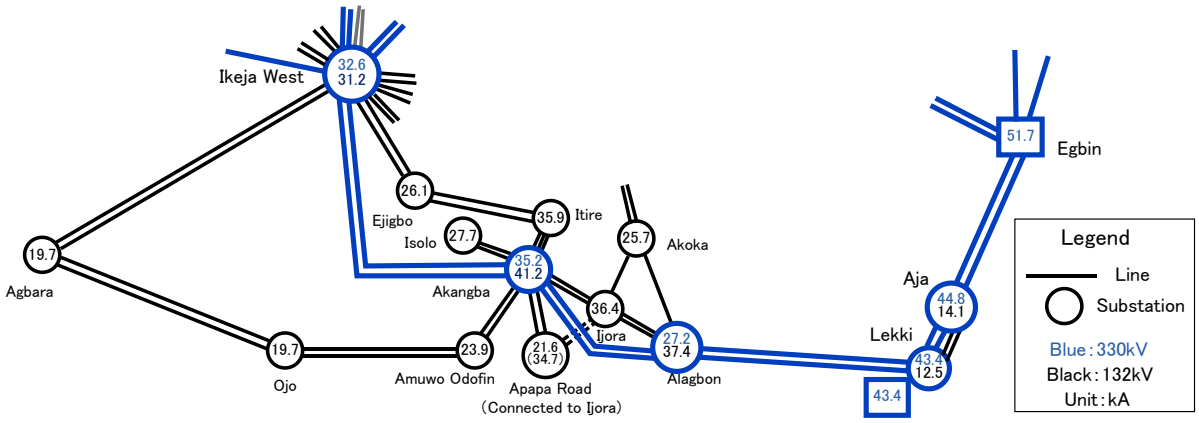
2) Fault current

Figure 2-2-15 shows the fault current analysis result around Apapa Road Substation. The fault currents in 132 kV are 41.2 kA at Akangba where all 8 units of 330/132 kV transformer operate in parallel, and 21.6 kA at Apapa Road. In case that Apapa Road Substation is interconnected to Akangba and Ijora, it becomes 34.7 kA at Apapa Road Substation.

Apapa Road-Ijora line is nearly completed in 2017, however, the difficulty to acquire land makes the completion delay.

Assuming that the line is completed until 2021 and Apapa Road Substation is interconnected to both Akangba Substation and Ijora Substation, the fault current in Apapa Road Substation will be 28.0 kA. Thus adopting 40 kA of circuit breaker rating for 132 kV is recommended for the following reason.

- existing circuit breaker rating is also 40 kA
- ensuring flexible network operation in the future, such as interconnection to both Akangba and Ijora Substation
- price difference between ratings of 31.5 kA and 40 kA is small



[Source] JICA Study Team

Figure 2-2-15 Fault current analysis result around Apapa Road Substation

(6) Conclusion

The precise study for power flow, fault current and stability proves that 2 units of 60 MVA transformer to be installed in Apapa Road Substation can be utilized effectively without problems.

Under present circumstances, Apapa Road Substation is connected to only one circuit of line branched T-shape from Akangba-Amuwo Odofin line in Akangba Substation. In time with this project, Apapa Road Substation will be connected to two circuits of Akangba-Apapa Road line by two circuit branching from Akangba-Amuwo Odofin line. The supply reliability for Apapa Road Substation will be improved. However, the irregular operation of T-shape branching from a transmission line does not change, hence, extending 132 kV bus bars in Akangba Substation and connecting the line to Apapa Road from the extended bus bar in a short time is strongly recommended.

Or uncompleted Ijora-Apapa Road line for the unsuccessful land acquisition should be completed in the short time so that the power supply source to Apapa Road Substation is doubled from Akangba and Ijora. This realizes supply reliability improvement and flexible network operation all together.

2-2-1-1-3 Adequacy of the Requested

(1) Renewal of 132 kV Switchgear Facilities

The 132 kV switchgear at Apapa Road Substation is GIS (Gas Insulated Switchgear) installed about 40 years ago. However, this GIS has never been used since 2012 because SF_6 gas with high electrical insulation had been leaked and switching performance of the gas circuit breaker had not been able to be retained owing to the deterioration of O ring of GIS connecting flange and grease. According to the TCN standard, bus at 132 kV substation should employ double buses, but presently the reliability required to 132 kV substation cannot be satisfied because one set of tentative switchgear protects two sets of 132/33 kV transformers and therefore, such tentative switchgear cannot work as bus.

The prospected longevity of a circuit breaker is about 26 years according to Japan Electric Industry

Association, and the time has come when presently unused GIS should be exchanged.

(2) Renewal of 132/33 kV transformer

Iron core and winding of 132/33 kV oil-contained transformer are placed in a container filled with insulation oil. Existing outdoor transformers in operation are 2 sets (TR 1, TR 2) and these sets are tertiary winding. And also, secondary winding transformer is installed as standby equipment.

Table 2-2-7 Specification of Existing Transformer

Name	Situation	Voltage (kV)	Rating Capacity (MVA)	Cooling System	Manufacturing Year
-	Stoppage	132/33	30	ONAF	1972
TR 1	In operation	132/33/11	45/30/20	ONAF	1974
TR 2	In operation	132/33/11	ONAN(ONAF) 45(59)/30(39)/20(26)	ONAN/ ONAF	1978

[Source] JICA Study Team made based on information from TCN

A transformer is generally the main equipment composing electric facilities. Deterioration diagnosis is needed after about 15 years have passed since its commission, and comprehensive deterioration diagnosis and measures to upgrade function and prolong its life are necessary. Also, the time comes when it needs to be exchanged after 20 or 30 years. All transformers at Apapa Road Substation have traces of oil leak from fin parts, and fins and pavement stones at their installed places have been darkened, and insulation oil is left in oil pits. Moreover, the color of moisture absorbent (silica gel) in the breather of insulation conservator has changed from blue to white, it can be presumed that a lot of moisture has entered transformers and facilitated deterioration of insulation oil. Standby transformer, whose primary and secondary bushing have been taken away, has been left stand without any use for a long time.

Automatically switching voltage devices were installed in TR 1 and TR 2 transformers, and they continuously monitored the secondary voltage of transformers in operation. In case the voltage deviated from the scope of setting voltage, the tap had been automatically changed without blackout, which could lead to the controllable situation. At present these devices doesn't work for some reasons, and voltage control has been executed by manual switching operation of tap. Insulation oil should be composed of mineral oil, but it is highly possible that transformers manufactured in 1970s may contain polychlorinated biphenyl (PCB), a harmful substance.

It is considered that time has come when TR 1 and TR 2 transformers should be exchanged because the above defect of 132/33 kV oil contained transformers and the length of about 40 year-operation was over the standard prospective lift of about 27 years (Japan Electrical Manufactures' Association). Moreover, power demand in Apapa Road area is forecasted to grow largely, and the demand by only the capacity of the current 132/33 kV transformer is forecasted to cause power shortage.

2-2-1-2 Policy on Natural Environmental Conditions

(1) Temperature and Humidity Conditions

The monthly average maximum daytime temperature is high throughout the year on the project sites, ranging between 25 °C and 30.0 °C. Thus, the Project will procure substation facilities in the light of the high temperature and ensure that these facilities will operate and be maintained properly even if the room temperature or humidity rises temporarily because of high outdoor air temperature or direct sunlight from outside.

(2) Rainfall and lightening stroke

It heavily rains around the project sites in the rainy season so that drainage measures must be taken to prevent rainfall from interfering with the operations of equipment to be installed. The sites where equipment is installed are on well-prepared grounds, but the grounds must be reasonably sloped to let rainwater run off to the surrounding of the premises or drainage trenches when the Nigerian side performs land preparation and ground leveling. As for lightning strikes, it is necessary to take measures against lightning strikes during the installation work of structures, build protection facilities against lightning infiltration from the power transmission and distribution lines, and ensure grounding.

(3) Chloride damage

The Project site is situated 700m away from lagoons in Lagos, and also is regarded as chloride damage area due to incoming salt from lagoons and smoke emission from factories. Therefore, equipment and materials should be chloride-damage proof.

2-2-1-3 Policy on Social and Economic Condition

In Lagos city where the Project site is located, there frequently happen blackouts, so private equity is being introduced to the construction of power plants and the upgrade of substations, and the expectation for the improvement of power situation is high. Moreover, the Project site supplies electricity to the largest trading port in Nigeria. Since factories of oil, cement, milling and so on concentrate around there, this area may give a large affection to economy of Nigeria. Materials supplied in the Project need to largely contribute to betterment of power situation in Lagos city, considering long perspective for social and economic situation in Nigeria. From this point of view, the power situation should be improved not merely by procurement of equipment and materials but also by technology transfer in order to improve the quality of operation of power supply facilities.

2-2-1-4 Policy on Construction/Procurement Condition or Specific Condition in the Sector/Business Practice

There are not only numerous local construction companies but also foreign construction companies in the Greater Lagos, which have wide variety of construction experiences from small to large scale. However, it is hard to say that there are enough engineers and crafts with advanced technology and knowledge regarding quality control and schedule control up to completion. Thus, in the implementation of foundation and

installation work of substation facilities in the Project, it is important to surely transfer technology of quality and construction scheduling through the supervision by Japanese engineers with high technology and knowledge.

Construction materials such as cement, rebar, aggregates, steel sash, and aluminum sash can be procured locally. Since there are fleshly mixed concrete factories for plant manufacturing in the Greater Lagos, the way of concrete placement at site shall be adopted in the Project in view of quality assurance.

2-2-1-5 Policy on Utilization of Local Contractors and Local equipment & Materials

(1) Local Contractors

Although in the Greater Lagos there are some local contractors which have the experiences of being involved in Japan ODA projects and the construction of TCN facilities, they will be utilized as subcontractors of Japanese enterprises from the viewpoint of securement of construction quality and achievement of safety management.

(2) Local Consultant

Since local consultants are adept at the construction situations, general specifications and constructing methods etc. of Nigeria, they will be utilized in supervision as adjuvant of Japanese consultants in the Project.

2-2-1-6 Policy on Operation & Maintenance Management

TCN has smoothly performed construction and operation & maintenance (O&M) work of transmission lines and substations since 2012 when TCN was unbundled from the electricity authority, and it has the O&M capacity to the some extent because it owns facilities nearly equal to equipment procured in the Project. At Apapa Road Substation, no maintenance staff member is stationed, and 4 system operators operate the substation for 24 hours in shifts. At the time of maintenance, maintenance staff members (quorum of 9 members) are dispatched and handle it from Ajah Sub Region Control Center, which controls the areas including this site. The organization chart of this center is shown in Figure 2-2-16. Presently O & M system in Apapa Road Substation needs improving because the records of daily inspection, periodical inspection and maintenance have been not well organized at the substation.

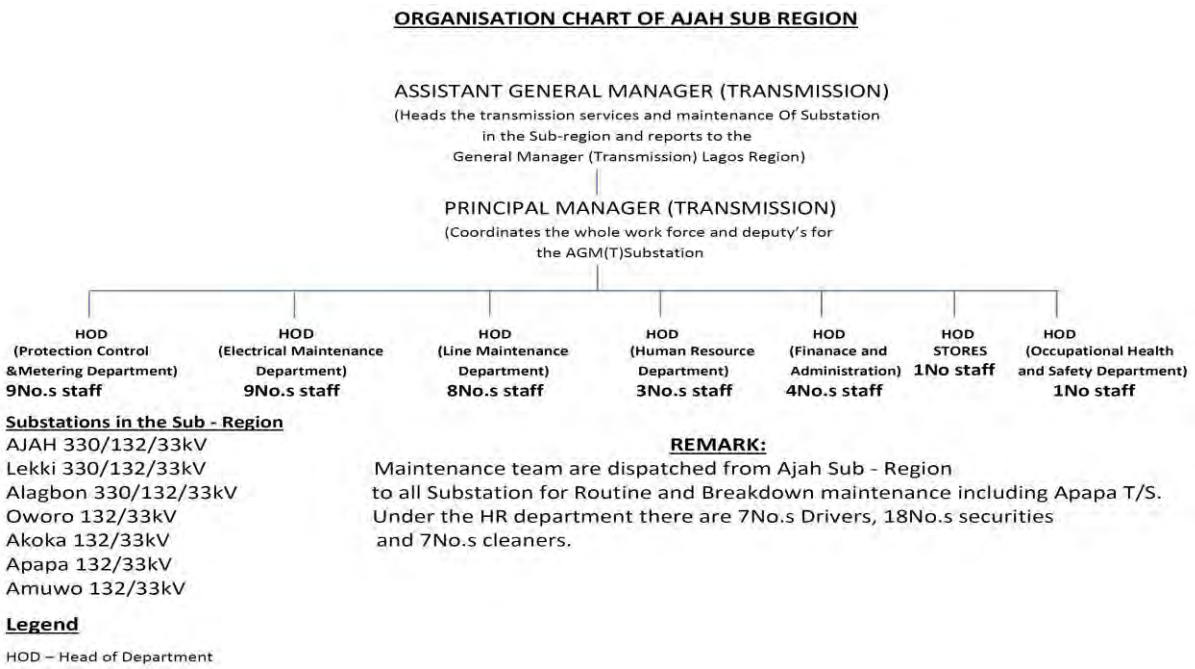


Figure 2-2-16 Organization Chart of Aja Sub Region

2-2-1-7 Policy on Grade Setting of Facilities and Materials

The scope and technological level of equipment and materials to be procured and installed under the Project will be determined in the light of the conditions described so far and in accordance with the following basic policies.

(1) The scope of Facilities & Equipment

To make technically and economically appropriate designing, the Project will adopt standard materials and equipment satisfying IEC or other international standards, as well as the minimum necessary compositions, specifications and quantities by using small numbers of types of materials and equipment, and work items for higher compatibility.

(2) The Technological Level

The Project will take into account the technological level of the sections and departments that will be in charge of O&M after the completion of the Project, and thus adopt components of simple specifications.

2-2-1-8 Policy on Construction/Procurement Methods, and Construction Schedule

Equipment & materials to be procured in Japan will be transported to Nigeria by sea. These items will be discharged at Lagos Port, and the road from the Port to Apapa Road Substation (the length of about 2km) is always jammed. Moreover, the run of danglers should be paid attention to in viewpoint of safety because the access road is right under the high-level road and there are a row of sidewalk vendors and the gate of the substation is narrow.

The local construction schedule should be determined chiefly in the light of the following matters.

- The electrification should be avoided by separating the exiting 132 kV switchgears by fences because construction work is performed near the place where the existing 132 kV switchgear in the substation is being charged.
- There are some areas where 33 kV and 11 kV underground cables appears on the ground in the substation site. The protection measures are needed for construction vehicles not to blight these cables.
- It is needed that there will never occur problems regarding the timing and period of the exchanging work, considering operation status of the existing facilities, because the work of exchanging between the existing and new facilities is necessary while the existing facilities are active.
- Following up is needed so that the time to bring in a mobile substation to Apapa Road Substation by TCN should be set by 45 days before the bidding publication date, and it will never affect construction work in Japan.
- Following up is needed so that the removal and transfer work of materials (control panel, container, circuit breaker, hanger for emergency generator, cars etc.) left in the Apapa Road Substation site will be finished by 45 days before tender publication in order not for the work to cause problems in construction in Japan.
- Since in Apapa Road Substation there is no storage space for equipment & materials, the land space in Akangba Substation needs to be rent in lieu thereof. That's why the consideration for the numbers of days of transfer is needed.

2-2-2 Basic Plan

2-2-2-1 Overall Plan

2-2-2-1-1 Design Condition

The design conditions in the Project are as follows;

(1) Meteorological Condition

Meteorological condition applied to the substation facilities and basic design is shown in Table 2-2-8.

Table 2-2-8 Meteorological Conditions

Item	Apapa Road Substation
Altitude of the ground	10 m above sea level
Ambient temperature (max)	38.0 ℃
Ambient temperature (min)	17.0 ℃
Ambient temperature (average)	27.3 ℃
Maximum wind speed	31.1 m/sec.
Annual rainfall (average)	1,689 mm
Seismic force	Not taken into account
Soil bearing capacity	150kN/m^2

[Source] JICA Study Tearm

(2) Design Conditions (132 kV System)

Table 2-2-9 132 kV Electric System

Item	Applicable
Nominal voltage	132 kV (3phase 3wire system)
System maximum voltage	145.0 kV
System miniimm voltage	118.8 kV
Frequency	50 Hz
Maximum short-circuit capacity	31.5 kA (1sec.)
Grounding system	Direct grounding
Grounding resistance	1 Ω or lower

[Source] TCN and Nigeria Electricity Regulatory Commission (NERC)

(3) Design Condition

1) Altitude: under 1,000 m

2) Design Temperature: 40 °C

3) System Voltage: 132 kV:132 kV ± 5%
33 kV: 33± 5%

4) Frequency: 50Hz±0.2Hz (Nigeria grid code allowed frequency)

5) Earth System: 132 kV: solidly grounded system
33 kV: Earth by grounded transformer

(4) Applicable Standard and Units

When designing the Project, IEC, ISO and international and Japanese standards will be applied to the major equipment. For units, the international System of Units (SI Units) will be used.

1) International Electrotechnical Commission (IEC): Applied to major functions of electrical products in general

2) International Organization for Standardization (ISO): Applied to performance evaluation of industrial products in general

3) Japanese Industrial Standards (JIS): Applied to industrial products in general

4) Japanese Electrotechnical Commission (JEC): Applied to electrical products in general

5) Standards of the Japan Electrical Manufacturers' Association (JEM): Ditto

6) Japan Electric Association Code (JEAC): Ditto

7) Standards of the Japanese Electrical Wire and Cable Makers' Association (JCS): Applied to electric wire and cables

8) Technical Standards concerning Electrical Equipment (Japan): Applicable to a wide range of electrical works

2-2-2-1-2 Type of Switchgear

Switchgears insulated in the air which are generally adopted at outdoor substations need more spacious squares in the design of equipment of substation because these devices need offset distance in the air for insulation of circuits by air and insulators. Most of the main equipment such as transformers are situated outdoors and only control equipment such as distribution board is situated indoors or in the cubicle. Switchgears insulated in the air is constructed at lower cost, and all equipment is set up horizontally, so it is excellent in the maintenance after the commission. However, the site of Apapa Road Substation is so narrow and the square for equipment to be placed is little, so the type of the insulation in the air cannot be adopted to switchgears of 132 kV and 33 kV.

GIS (Gas Insulated Switch) is a shrinkage-type switchgear facility in which breakers, isolator, buses, lightning arrestor, transformer for indicators, and substation earthing devices etc. are contained in unit container with highly insulating gases (sulfur hexafluoride: SF_6). It cut down about 30-40% as installed squares compared to switchgear insulated in the air.

That's why GIS in the Project shall be adopted as 132 kV and 33 kV switchgear. GIS has merits of conservation of square, high security and high reliability, but it has demerits of high equipment cost and construction cost.

2-2-2-1-3 Layout Planning of substation

The construction such as upgrade of 132 kV/33 kV GIS, installment of transformers and construction of substation building is to be implemented in the existing Apapa Road Substation. In the future the plan is such as expansion of 132/33 kV GIS is possible. The site of Apapa Road Substation is narrow and situated in densely populated area, so the adoption of GIS has merits as follows;

(1) Facilities with high fire-proof

(2) The minimization of installation area

(3) Dampening of corona discharge sounds

(4) Environmentally friendly and no given visual impact

(5) Decreasing in size of substation facilities because transmission towers become unnecessary in the connection with transmission lines and underground power cables become applicable.

The layout of substation equipment should be designed so that there will occur no problem in carrying in and out equipment and materials, and based on the following items to be considered.

(1) To secure the minimum separation of equipment according to fire protection law in viewpoint of security and fire prevention

(2) To take anti-inundation measurements such as installation at higher levels or water tight doors under consideration of forecasted water inundated depth in case that inundation by tsunami or floods occurs.

(3) To take measurers of no entry except authorized personnel.

2-2-2-2 Plan for Equipment and Materials

2-2-2-2-1 Outline of Basic Plan

Reasonability of specifications of electric equipment was verified from the survey results of the current and future power supply/demand situation. The use result and status of development of facilities and materials of the executing agency was also surveyed. The outline of basic plan based on the above survey results is shown in Table 2-2-10.

Table 2-2-10 Outline of Basic Plan

No.		Equipment	Unit	Q'ty
AR	Apapa Road Substation			
AR1	Equipment of 132 kV incoming transmission line			
	AR1-1	120 kV Lightning arrestor	Set	2
	AR1-2	132 kV Blocking coil	Unit	2
	AR1-3	132 kV Capacitor voltage transformer	Set	2
	AR1-4	132 kV Cable head	Set	3
	AR1-5	132 kV Power cable	Set	1
	AR1-6	132 kV Power cable support	Set	1
AR2	132 kV GIS and transformer			
	AR2-1	132 kV Incoming GIS	Set	2
	AR2-2	132 kV Bus coupler GIS	Set	1
	AR2-3	132 kV Voltage transformers GIS	Set	1
	AR2-4	132 kV Transformers feeders GIS	Set	2
	AR2-5	132/33 kV Transformers	Unit	2
AR3	Control and protection device			
	AR3-1	132 kV Incoming GIS control and protection panel,	Set	2
	AR3-2	132/33 kV Transformer GIS control and protection panel	Set	2
	AR3-3	132 kV Bus coupler GIS protection panel	Set	1
	AR3-4	Supply energy meter panel (Supply energy meter is supplied by Customer)	Panel	1
	AR3-5	Supervisory control panel (RTU)	Panel	1
	AR3-6	SCADA system (For substation service only)	Set	1
AR4	33 kV Gas Insulated Switchgears (GIS)			
	AR4-1	33 kV Transformer GIS	Panel	2
	AR4-2	33 kV Distribution GIS	Panel	6
	AR4-3	33 kV Bus coupler GIS		
	AR4-3-1	33 kV Bus coupler (CB) GIS	Panel	1
	AR4-3-2	33 kV Bus coupler (Bus riser) GIS	Panel	1
	AR4-4	33 kV Voltage transformer GIS	Panel	2
	AR4-5	33 kV Power cable	Set	1
	AR4-6	33 kV Ring main unit	Set	1
AR5	Other incidental facilities			
	AR5-1	DC110V Power supply system (regular-use and standby type including DC distribution board)	Set	1
	AR5-2	AC Power supply system (regular-use and standby type including AC	Set	1

No.		Equipment	Unit	Q'ty
		distribution board)		
	AR5-3	Substation earthing	Set	1
	AR5-4	Grounding transformer (in common use of station service transformer)	Unit	2
	AR5-5	Emergency generator	Unit	1
	AR5-6	Overhead traveling crane	Set	1
	AR5-7	Others, control cables etc.	Set	1
AK	Akangba Substation			
AK1	132 kV transmission line T branching equipment material			
	AK-1-1	132 kV Transmission gantry	Set	1
	AK-1-2	132 kV Transmission line material	Set	1
MT	Test and Maintenance Equipment			
	MT-1	Vacuum transformer oil purifier	Set	1
	MT-2	Transformer oil breakdown voltage tester	Set	1
	MT-3	Protection relay tester	Set	1
	MT-4	SF_6 Gas handling unit for GIS	Set	1
	MT-5	Power meter	Set	1
	MT-6	Aerial work platform	Unit	1

2-2-2-2-2 Equipment and Facilities

The equipment and facilities delivered from Japan to Apapa Road Substation are shown in Table 2-2-11, excerpted from Apapa Road Substation single line linkage figure.

Table 2-2-11 Outline of Equipment to Be Procured and Installed of APAPA Road Substation

No.	Description	Specifications
AR1	**132 kV Incoming transmission line**	
AR1-1	**120 kV Lightning Arrestor** **1. Component** (1) 120 kV lightning arrestor **2. Specification** (1) Applicable standard (2) Format (3) Rated voltage (4) Discharge current (5) Lightning Impulse (Discharge capacity) (4/20 μs) (6) Accessories	 6 units (3 units/set) IEC, JEC, JIS, JEM or equivalent standard Outdoor type, zinc oxide type 120 kV 10 kA 100 kA Operation display device (each phase), stand, ODA plate or sticker, other necessary items
AR1-2	**132 kV Blocking coil** **1. Component** (1) 132 kV Blocking coil **2. Specification** (1) Applicable standard (2) Type (3) Maximum working voltage (4) Nominal lightning impulse withstand voltage	 2 units IEC, JEC, JIS, JEM or equivalent standard CVT mounted type or suspended type 132 kV 35 kV

No.	Description	Specifications
	(5) Rated current	1,600 A
	(6) Rated short-term withstand current	40 kA
	(7) Rated short circuit time	1 sec.
	(8) Impedance	125 Ω or more in communication frequency
	(9) Communication frequency	152 - 504 kHz
	(10) Accessories	Hanging bracket, surge suppressing gap device, ODA plate or sticker, other necessary items
	(11) Installation location	Apapa Road Substation rooftop
AR1-3	**Capacitor voltage transformer**	
	1. Component	
	(1) 132 kV instrument transformer for measurement	6 units (3 units/set)
	2. Specification	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	1) Capacitor type 2) Insulator leakage distance: 31 mm/kV or more
	(3) Maximum working voltage	145 kV
	(4) Nominal thunder impulse withstand voltage	650 kV
	(5) Rated primary voltage	132/√ 3 kV
	(6) Rated secondary voltage	110/√ 3 V, 110/√ 3 V
	(7) Number of windings	2
	(8) Commercial frequency withstand voltage 1 minute	275 kV
	(9) Capacitance C1, C2	Manufacturer recommended
	(10) Rating burden	100 VA or more
	(11) Accuracy	Class 1.0/3P
	(12) Accessories	Stand, ODA plate or sticker, other necessary items
	(13) Remarks	Consider signal input for PLC communication
AR1-4	**132 kV Cable head**	
	1. Construction	
	(1) 132 kV cable head	9 units (3 units/set)
	1) For 132 kV power line lead-in	6 units (3 units/set)
	2) For mobile substation	3 units (3 units/set)
	(2) Terminal treatment material	27 pieces (9 unit/set)
	(3) Connection line to lead-in line from power transmission line	3 set (1 set/set)
	(4) Connection line from 132 kV cable head to mobile substation	1set (1 set/set)
	(5) Stand	3 sets (1set/set)
	(6) Linear connection material	3 pieces (1 piece/set)
	1. Specification	
	(1) 132 kV cable head	
	1) Lightning impulse withstands voltage (BIL)	650 kV
	2)Minimum nominal required leakage distance	31.5 mm/kV
	3) Partial discharge	5 pc or less
	(2) Terminal treatment material	XLPE for 1 c - 400 mm^2, outdoor salt resistant
	(3) Connection to lead-in line from transmission line	ACSR

No.	Description	Specifications
	(4) Connection from 132 kV cable head to mobile substation	ACSR
	(5) Stand	1) High strength steel 2) Hot-dip galvanizing 3) ODA plate or sticker 4) Common base stand : 120 kV surge arrestor, 132 kV blocking coil, 132 kV condenser type instrument transformer and 132 kV cable stand
	(6) Linear connection material	1) Including a stand for mobile substation 2) XLPE 1C-400 mm^2, outdoor, salt resistant
	3. Replacement parts	
	(1) Terminal treatment material (GIS side)	3 units
	(2) Terminal treatment material (Transformer side)	3 units
	4. Other notice .	Conductor shall be copper material.
AR1-5	**132 kV Power cable**	
	1. Construction	
	(1) 132 kV power cable	1 set (1,140 m/set)
	(2) Terminal material	6 pieces
	2. Specification	
	(1) 132 kV power cable	
	1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	2) Type	Single core, copper conductor, Cross-linked polyethylene (XLPE) cable
	(3) Conductor material	Copper
	(4) Conductor size	400 mm^2
	(5) Maximum working voltage	145 kV
	(6) Rated lightning impulse withstand voltage	650 kV
	(7) Metal shield	Copper tape
	(8) Metal sheath	Aluminum sheath
	(9) Protective layer	Polyvinyl chloride or polyethylene
	(10) Cable terminal treatment	6 places
	3. Terminal treatment material	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Minimum nominal required leakage distance	31.5 mm/kV
	(3) Partial discharge	5 pc or less
	4. Other notice	1) To lay pipes with corrugated rigid polyethylene pipes and hand holes 2) Cable length is 1,140 m.
AR1-6	**132 kV Power cable support**	
	1. Construction	
	(1) 132 kV power cable support	1 set
	2. Specification	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Steel materials	High tensile strength steel
	(4) Painting	Hot-dip galvanizing
	(5) Cable specification	132 kV XLPE - 1 C - 400 mm 2/phase, 6 cables (3 phase x 2 circuits)
	(6) Others	Point to be noted the cable bending radius.

No.	Description	Specifications
AR2	**132 kV GIS and transformer**	
AR2-1	132 kV GIS Common specification	
AR2-2	**1. Construction**	
AR2-3	(1) AR2-1: 132 kV Incoming GIS	2 sets
AR2-4	(2) AR2-2: 132 kV Bus coupler GIS	1 set
	(3) AR2-3: 132 kV Voltage transformer GIS	1 set
	(4) AR2-4: 132 kV Transformer GIS	2 sets
	2. Specification	
	132 kV GIS	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent standard
	(2) Type	Outdoor type, three-phase in one enclosure and metal enclosed type
	(3) Bus type system	Double bus type
	(4) Connection	Cable connection
	(5) Control	Remote control from the control room and SCADA (Note: Local control panel is not installed.)
	(6) Rated voltage	132 kV
	(7) Maximum voltage	145 kV
	(8) Rated frequency	50 Hz
	(9) Rated bus current	2,000 A
	(10) Rated breaking current	40 kA or more
	(11) Responsibility for operating GIS	O - 0.3 sec. - CO - 3 min. - CO
	(12) Rated short time withstand current	40 kA (3 sec.) Or more
	(13) Rated impulse withstand voltage	650 kV or more
	(14) Rated commercial frequency withstand voltage	275 kV or more
	(15) Control voltage	110 V DC
	(16) Interruption time	60 ms or less
	(17) Closed time	80 ms or less
	(18) Auxiliary contact	NO: 7 pieces, NC: 7 pieces or more
	(19) Painting	-Heavy-duty salt-resistant paint finish for outdoor use -Paint color: N 7 or RAL 7033
	(20) Accessories	Name plate, space heater, MCCB with alarm contact, door handle with key, ODA plate or sticker
	3. Replacement parts	Including in AR2-1
	4. Other notice	
	(1) Painted specifications	To withstand outdoor installation
	(2) For future space	Consider the space for the incoming switch (2 pairs) and the transformer switch (2 pairs)
	(3) GIS loading and maintenance	Consider using the crane at rated load (5 tons)
AR2-1	**132 kV Incoming GIS**	
	1. Construction	
	(1) Circuit breakert	2 units (1 unit/set)
	(2) Disconnector	6 units (3 units/set)
	(3) Grounding device	
	1) For input capacity	2 units (1 unit/set)
	2) For maintenance	4 units (2 units/set)
	(4) Current transformer	24 pieces (12 pieces/set)
	(5) Lightning arrester	6 units (3 units/set)
	(6) Cable connection unit	2 lot (1 set/set)
	2. Specification	
	(1) Circuit breaker	132 kV, 2,000 A, 40 kA - 3 sec. Or more
	(2) Disconnector	132 kV, 2,000 A, 40 kA
	(3) Grounding device	
	1) For input capacity	132 kV, 40 kA - 3 sec. or more

No.	Description	Specifications
	2) For maintenance	132 kV
	(4) Current transformer	1) 2,000-1,000/1 A, 15 VA or more, 5P20 2) 600-400/1/1/1A, 15 VA or more, Class 1.0/5P20/5P20
	(5) Lightning arrester	120 kV, 10 kA,
	(6) Cable connection unit	XLPE cable, 1c - 400 mm^2/phase
	3. Replacement parts	
	(1) Closing coil for circuit breaker	1 piece
	(2) Tripping coil for circuit breaker	1 piece
	(3) Closing electromagnetic contactor for disconnector and grounding device	1 piece
	(4) Opening electromagnetic contactor for disconnector and grounding device	1 piece
	(5) Interlocking coil for disconnector and grounding device	1 piece
	(6) Space heater	6 pieces
	(7) SF_6 gas cylinder	3 pieces
AR2-2	**132 kV Bus coupler GIS**	
	1. Construction	
	(1) Circuit breaker	1 unit (1 unit/set)
	(2) Disconnector	2 units (2 units/set)
	(3) Grounding device(Maintenance)	2 units (2 units/set)
	(4) Current transformer	6 pieces (6 pieces/set)
	2. Specification	
	(1) Circuit breaker	132 kV, 2,000 A, 40 kA - 3 sec. or more
	(2) Disconnector	132 kV, 2,000 A
	(3) Grounding device (Maintenance)	132 kV
	(4) Current transformer	2,000/1/1 A, 15 VA or more, Class 1.0/5P20
AR2-3	**132 kV Transformer GIS**	
	1. Construction	
	(1) Voltage transformer	6 units (6 units/set)
	(2) Grounding device(Maintenance)	2 units (2 units/set)
	2. Specification	
	(1) Voltage transformer	132/√3 kV, 110/√3 V, 110/√3 V, 100 VA or more,Class:1.0/3P
	(2) Grounding device(Maintenance)	132 kV
AR2-4	**132 kV Transformer GIS**	
	1. Construction	
	(1) Circuit breaker	2 units (1 unit/set)
	(2) Disconnector	4 units (2 units/set)
	(3) Grounding equipment (Maintenance)	4 units (2 units/set)
	(4) Cable connection unit	2 sets (1 set/set)
	(5) Current transformer	18 pieces (9 pieces/set)
	2. Specification	
	(1) Circuit breaker	132 kV, 1,250 A, 40 kA- 3 sec. or more
	(2) Disconnector	132 kV, 1,250 A, 40 kA or more
	(3) Grounding equipment (Maintenance)	132 kV
	(4) Cable connection unit	For XLPE cable (1 c - 400 mm^2/phase)
	(5) Current transformer	1) 2,000-1,000/1 A, 15 VA or more, 5 P 20 2) 400/1/1/1A, 15 VA or more, Class 1.0/5P20/5P20

No.	Description	Specifications
AR2-5	**132/33 kV Transformer**	
	1. Construction	
	132/33 kV transformer (T1, T2)	2 units
	2. Specification	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	Outdoor type, with load tap changeover device, non-compression tight type
	(3) Rated capacity	60 MVA (ONAF)
	(4) Rated voltage	Primary voltage 132 kV, Secondary voltage 33 kV
	(5) Rated frequency	50 Hz
	(6) Number of phases	3-phase
	(7) Cooling method	Oil natural air natural type/Oil natural air-forced type (ONAN/ONAF)
	(8) Connection method	1) Primary side: star connection (direct ground) 2) Secondary side: triangular connection (grounding by grounding transformer), 3) Vector group: YNd 11
	(9) Rated lightning impulse withstand voltage	1) Primary side: 650 kV or more 2) Primary side neutral point: 125 kV or more 3) Secondary side : 170 kV or more
	(10) Rated commercial frequency withstand voltage (1 minute)	1) Primary side: 275 kV or more 2) Primary side: neutral point 38 kV or more 3) Secondary side: 70 kV or more
	(11) Impedance	Approximately 13% (at 60 MVA)
	(12) Tap changeover device on load	
	1) Type	Vacuum valve type
	2) Tap voltage	132 kV, + 5% (+4 x 1.25%), – 15% (-12 x 1.25%)
	3) Number of taps	17 taps
	4) Step voltage	1.25%
	5) Tap position external output	Local display, remote display and transformer parallel operation
	(13) CT	
	CT (neutral point in primary)	400/1/1/1/1 A, 15 VA, Class 0.5/5P20/5P20/Spare
	Bushing CT (secondary)	1,200/1/1/1/1 A, 15 VA, Class 0.5/5P20/5P20/Spare
	(14) Lightning arrester	Primary side and secondary side
	(15) Connection	1) Primary side: cable connection (XLPE cable: 1 x 400 mm^2/phase) 2) Secondary side: cable connection (XLPE cable: 2 x 630 mm^2/phase)
	(16) Noise	1) Less than 75 dB(A) in ONAN 2) Less than 78 dB(A) in ONAF
	(17) Painting	Heavy-duty salt-resistant paint finish (paint color: N7 or RAL 7033)
	(18) Accessories	1) Insulation oil 2) Buchholz relay with alarm contact 3) LTC oil flow relay 4) Oil level gauge with alarm contact 5) Oil temperature gauge with alarm contact 6) Oil temperature detection element for external display 7) Winding temperature detection element 8) Pressure relieving device with alarm contact 9) Pressure relief tank 10) Moisture absorption respirator 11) Lift ladder 12) Manual handles for LTC 13) ODA plate or sticker, etc.
	3. Replacement parts	
	(1) 132 kV side bushing	1 unit
	(2) 33 kV side bushing	1 unit

No.	Description	Specifications
	(3) Buchholz relay	1 piece
	(4) Oil temperature gauge	1 piece
	(5) Oil level gauge	1 piece
	(6) MCCB (various)	1 piece
	(7) Auxiliary relay (various)	1 piece
	(8) Fuse (various)	100%
	(9) Lamp (various)	100%
	(10) LED lamp (various, with socket)	10 %
	4. Consumables	
	Silica gel	3 cans (20 kg/can)
	5. Other notice	1) To enable parallel operation at two transformers (T1/T2). 2) Secure in addition to two set of new transformer the space as two set of transformer is planned in the future. 3) Elephant type (cable box) connection shall be made for both 132 kV and 33 kV sides. 4) To provide a terminal block for grounding transformer 5) To prevent scattering of insulating oil by pressure releasing tank which collects insulating oil discharged during relief operation. 6) To provide fire wall and oil-proof dick with drain and valve
AR3	**Control and protection device**	
AR3-1	**1. construction**	
AR3-2	AR3-1: 132 kV Incoming GIS control and / protection panel	2 sets
AR3-3		
AR3-4	AR3-2 : 132 kV 132/33 kV Transformer GIS control / protection panel	2 sets
AR3-5		
AR3-6		
	AR3-3: 132 kV Bus coupler GIS protection panel	1 set
	AR3-4: Supply energy meter panel (supply energy meter is supplied by Costumer)	1 panel
	AR3-5: Supervisory remote control panel (RTU)	1 panel
	AR3-6: SCADA system (For substation)	1 set
	2. Specification	
	Common specifications for control and protection equipment	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent standard
	(2) Type	Indoor type, metal enclosed type, self-standing panel
	(3) Panel configuration	Remote control by SCADA
	1) Monitoring protection panel	Vertical free-standing type, fixed front side and rear side door, 132 kV monitoring panel should be mimic bus type to identify the system.
	2) Power meter panel and SCADA interface board	Single board and install it in the electric room.
	(4) Control voltage	DC 110 V
	(5) Measurement function	Measurement and display of voltage, current, active power, reactive power etc. for 132 kV line, multifunction type meter
	(6) Monitoring function	1) Mimic bus type, Status display of 132/33kV switchgear (33 kV switchgear is for transformer circuit breaker and bus bar breaker only) 2) 132/33 kV transformer tap indication

No.	Description	Specifications
		3) Fault alarm indication, etc.
	(7) Operation function	1) 132/33 kV switchgear display with changeover switch to enable remote operation 2) Operation of 132/33 kV transformer on load tap changer, etc.
	(8) Protection function	1) Transmission line protective relay 2) Transformer protective relay 3) Bus protective relay, etc.
	(9) Accessories	1) Collective type alarm indicator 2) MCCB with alarm contact 3) Current/voltage test terminal 4) ODA plate or sticker, etc.
	4. Other notice	(1) Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel. (2) To install an insect repellent net on the opening
AR3-1	**132 kV Incoming GIS control and protection panel**	
	1. Construction	
	1) 132 kV GIS control panel for Incoming	2 panels (1 panel/set)
	2) 132 kV GIS protection panel for incoming	2 panels (1 panel/set)
	2. Specification of 132 kV GIS control panel for Incoming	
	(1) Operation function	1) Operation of switchgear in 132 kV incoming switchgear 2) To provide an interlock circuit for realizing safe operation
	(2) Measurement function	Measurement and display of voltage, current, active power, reactive power etc. for 132 kV incoming switchgear by using multifunction type meter
	(3) Monitoring function	Status display and failure alarm display, etc. for 132 kV incoming switchgear.
	(4) Accessories	Collective type alarm indicator, MCCB with alarm contact, etc.
	3. Specification of 132 kV GIS protection panel for incoming	
	(1) Protective relay	21 (Distance relay), 67 (AC directional overcurrent relay), 67N (AC directional ground fault relay), 78 (Phase-angle measuring or out-of-step protective relay), 79 (AC reclosing relay), 50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 50BF (Breaker failure relay), 27 (Under voltage relay), 59 (Overvoltage relay), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc.
	(2) Accessories	Current/voltage test terminal, alarm indicator, MCCB with alarm contact, etc.
	4. Replacement parts	
	(1) Protective relays (various)	1 piece
	(2) meter (various)	1pice
	(3) Switch (various)	1 piece
	(4) Lamp (various)	100%
	(5) LED lamp (various, with socket)	10%
	(6) MCCB (various)	1 piece
	(7) Auxiliary relay (various)	3 pieces
	(8) Electromagnetic contactor (various)	1 piece
	5. Other notice	Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel.

No.	Description	Specifications
AR3-2	**132 kV Transformer GIS control and protection panel**	
	1. Construction	
	1) 132 kV GIS control panel for transformer	2 panels (1 panel/set)
	2) 132 kV GIS protection panel for transformer	2 panels (1 panel/set)
	2. Specification of 132 kV GIS control panel for transformer	
	(1) Operation function	1) Operation of switchgear in 132 kV transformer switchgear. 2) Provide an interlock circuit for realizing safe operation.
	(2) Measurement function	Measurement and display of voltage, current, active power, reactive power etc. for 132 kV transformer switchgear by using multifunction type meter
	(3) Monitoring function	Status display and failure alarm display, other of 132 kV transformer switchgear.
	(4) Accessories	Collective type alarm indicator, MCCB with alarm contact, etc.
	(5) Others	It may be integrated with monitoring board for 132/33 kV transformer.
	3. Specification of 132 kV GIS protection panel for transformer	
	(1) Protective relay	87T (Differential transformer protective relay), 64REF (Low impedance restricted ground fault)*, *primary side and secondary side of transformer, 50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 50BF (Breaker failure relay), 25 (Synchronizing or synchronism-check), 27 (Under voltage relay), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc.
	(2) Accessories	Current/voltage test terminal, alarm indicator, MCCB with alarm contact, etc.
	4. Other notice	Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel.
AR3-3	**132 kV bus coupler GIS control and protection panel**	
	1. Construction	
	1) 132 kV GIS control panel for bus coupler	1 panel (1 panel/set)
	2) 132 kV GIS protection panel for bus coupler	1 panel (1 panel/set)
	3) 132 kV GIS protection panel for bus	1 panel (1 panel/set)
	2. Specification of 132 kV GIS control panel for bus coupler	
	(1) Operation function	1) Operation of opening/closing of 132 kV bus coupler switchgear. 2) Provide an interlock circuit for realizing safe operation.
	(2) Measurement function	Measuring and display of voltage, current, electric active power, reactive power etc. for132 kV bus coupler switchgear. (using multifunction type meter)
	(3) Monitoring function	Indicator open/close status indicator, fault alarm display, other for fault alarm display, etc.
	(4) Accessories	Collective type alarm indicator, MCCB with alarm contact, etc.
	3. Specification of 132 kV GIS protection panel for bus coupler	
	(1) Protective relay	50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 25 (Synchronizing or

No.	Description	Specifications
		synchronism-check), 50BF (Breaker failure relay), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc.
	(2) Accessories	Current / voltage test terminal, alarm indicator light, MCCB with alarm contact, etc.
	4. Specification of 132 kV GIS protection panel for bus	
	(1) Protective relay	87B (Differential bus protective relay), 86 (Lockout relay), etc.
	(2) Accessories	MCCB with alarm contact, etc.
	5. Other notice	Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel.
AR3-4	**Supply energy meter panel (Supply energy meter is supplied by Costumer)**	
	1. Construction	
	(1) Supply energy meter panel	1 panel
	(2) 33 kV Supply energy meter	6 units (supply energy meter is supplied by Client)
	2. Specification of supply energy meter panel	
	(1) Type	Inside type, metal enclosed type, transparent glass is used in front, and supply power meter is visible from outside.
	(2) Control voltage	DC 110V
	(3) Accessories	Nameplate, inside panel lighting, temperature controlled space heater, door handle with keys
	3. Specification of 33 kV supply energy meter	
	(1) Supply energy meter	Supply energy meter is installed and wired in site
	(2) Place of installation	Supply energy meter panel
AR3-5	**Supervisory control panel (RTU)**	
	1. Construction	
	(1) Supervisory control panel (RTU)	1 set
	2. Specification	
	(1) Type	Indoor type, metal enclosed type
	(2) Kind of signals	
	1) Digital output	Status indication of switchgear (circuit breaker, disconnector and grounding device), transformer tap position indication, operation state of various relays, various alarm signals
	2) Digital input	Opening and closing signal of switchgear (circuit breaker and disconnector), etc.
	3) Analog output	Analog signals such as voltage, current, active power, reactive power, frequency
	4) Pulse output	Pulse signal of energy
	(3) Accessories	Nameplate, lighting inside the panel, temperature controlled space heater, door handle with key
	(4) Others	To consider the terminal board space for planned extension equipment in future
	3. Other notice	Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel.

No.	Description	Specifications
AR3-6	**SCADA system (for substation service only)**	
	1. Construction	
	(1) SCADA system software	1 set
	(2) Personnel computer or work station	More than 1 unit
	(3) LCD monitor	2 units
	(4) Printer	1 unit
	(5) Keyboard and mouse	2 sets
	(6) Input-output interface	1 set
	(7) Analog data interface	1 set
	(8) Fiber optic interface	1 set
	(9) Cables	1 set
	(10) Remote terminal unit (RUT master station)	1 set
	2. Specification	
	2.1 SCADA system software	
	(1) Monitoring function	
	1) Status monitoring	a) Displays the single diagram on the monitor, and displays on / off state of the switch, measurement information such as voltage, current, active power, reactive power b) Displays the status of the equipment necessary for substation operation, such as status indication of switch, relay lock, tap indication of the transformer, etc.
	2) Display of alarm /malfunction information	To have a function to report and display to the operator such as alarm, relay operation, automatic trip of circuit breaker, success or unsuccessful of reclose as for equipment failure, transmission line fault, fault in substation, etc.
	3) Voltage monitoring/overload monitoring function	To have a function to monitor automatically and display an alarm when occurs over voltage, under voltage, over load of transmission line and transformer
	(2) Control function	
	1) Control/selection	a) Switchgear control of circuit breaker and disconnector, tap control of transformer, operation/lock of protective relay, ON/OFF control of remote control equipment, etc. b) The operation must be having method that can prevent misunderstanding and illusion by using two behavior controller in selection and execution.
	2) Status indication of non-remote control equipment such as grounding device	Equipment that is manually operated, such as earth ground for maintenance, shall have the function that the condition can be displayed on the screen by the operator.
	(3) Recording function	
	1) Daily/monthly report recording	a) To be able to print and record measurement information such as voltage, active power, reactive power of substation as daily report and monthly report from printer b) Electronic data can output as electronic data in file form such as excel data.
	2) Event recording of warning/ malfunction information	a) Alarm/fault information occurred at the substation can be accumulated as a database and printed and outputted from the printer. b) Electronic data can output as electronic data in file form such as excel data.
	3) Event recording of operation information:	The operation information of the substation operated by the system can be accumulated as a database and printed and outputted from the printer as necessary.

No.	Description	Specifications
	(4) Change setting function	
	1) Voltage monitoring / overload monitoring setting function	To enable to set an alarm level of upper and lower limit of voltage monitoring, a numerical value for overload monitoring of transmission line and transformer
	2) Data maintenance function	a) To enable to set items to be recorded in the daily and monthly report b) To enable to set record time, change the name of distribution line, etc. 5) The name of the distribution line can be changed.
	2.2 Personnel computer or work station	To have sufficient processing capability when executing data processing of normal monitoring control
	2.3 LCD monitor	21 inches or more
	2.4 Printer	Leaser printer
	2.5 Keyboard and mouse	English letter
	2.6 Input-output interface	Contact information with substation equipment
	2.7 Analog data interface	Multi meter measurement information such as voltage and current, etc.
	2.8 Fiber optic interface	Optical communication information of Apapa Road substation
	2.9 Cables	Connection cable between each device
	2.10 Remote terminal unit (RUT master station)	a) Receive monitoring information of monitoring information of Apapa Road substation and send control signal of the substation b) To have contacts to send to RTU board
	3. Other notice	Applicable standard is IEC, JEC, JIS, JEM or equivalent standard
AR4	**33 kV Gas Insulated Switchgears (GIS)**	
AR4-1	**1. Construction**	
AR4-2	(1) AR4-1: 33 kV transformer GIS	2 panels
AR4-3-1	(2) AR4-2: 33 kV distribution GIS	6 panels
AR4-3-2	(3) AR4-3-1: 33 kV bus coupler (CB) GIS	1 panel
AR4-4	(4) AR4-3-2: 33 kV bus coupler (Bus riser) GIS	1 panel
	(5) AR4-4: 33 kV voltage transformer GIS	2 panels
	2. Specification	
	33 kV GIS common specification	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent standard
	(2) Type	Indoor type, metal enclosed type
	(3) Cable capture	Bottom part of panel
	(4) Control	To enable to control remotely from control room and SCADA
	(5) Protective relay	1) To install protective relay on each protection panel 2) Digital relay
	(6) Rated voltage	33 kV
	(7) Rated frequency	50 Hz
	(8) Rated bus current	2,000 A or more
	(9) Rated breaking current	25 kA or more
	(10) Circuit breaker operating duty	O - 0.3 sec. - CO - 3 min. - CO
	(11) Rated Short time withstand current	25 kA (3 sec.) or more
	(12) Lightning impulse withstand voltage	170 kV or more
	(13) Power frequency withstand voltage	70 kV or more
	(14) Circuit breaker	GCB or VCB
	(15) Control voltage	DC 110 V (operation, motor), AC 240 V (heater)
	(16) Accessories	Name plate, current/voltage test terminal, space heater, MCCB with alarm contact, door handle with key, ODA plate or sticker

No.	Description	Specifications
	(17) Others 1) Installation location	 2nd floor in control building
AR4-1	**33 kV Transformer GIS** **1. Construction** (1) Circuit breaker (2) Disconnector (3) Grounding device (4) Measurement and protection (5) Cable connection unit **2. Specification** (1) Circuit breaker (2) Disconnector (3) Grounding device (4) Measurement and protection 1) Measurement 2) Protective relay (5) Cable connection unit **3. Replacement parts** (1) Lamp (various) (2) LED lamp (various, with socket) (3) MCCB (various) (4) Protective relay (various) (5) Auxiliary relay (various) (6)Electromagnetic contactor (various) (7) Tripping coil (various) (8) Closing coil (various) (9) Temperature controlled Space heater (10) Meter (various) (11) Switch (various)	 2 units (1 unit/panel) 2 units (1 unit/panel) 4 units (2 units/panel) 2 set (1 set/panel) 2 set (1 set/panel) 33 kV, 1,250 A, 25 kA - 3 sec. or more 33 kV, 1,250 A, 25 kA 33 kV Multifunction meter (voltage, current, active power, reactive power, energy meter), voltage detection device 50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 67 (AC directional overcurrent relay), 67N (AC directional ground fault relay), 25 (Synchronizing or synchronism-check), 27 (Under voltage relay), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc. XLPE cable (2 x 1c - 630 mm^2/phase) 100% 10% 1 piece 1 piece 3 pieces 1 piece 1 piece 1 piece 1 piece 1 piece 1 piece
AR4-2	**33 kV Distribution GIS** **1. Construction** (1) Circuit breaker (2) Disconnector (3) Grounding device (4) Current transformer (5) Measurement and protection (6) Lightning arrester (6) Cable connection unit **2. Specification** (1) Circuit breaker (2) Disconnector (3) Grounding device (4) Current transformer (5) Measurement and protection 1) Measurement	 6 units (1 unit/panel) 6 units (1 unit/panel) 12 units (2 units/panel) 36 pieces (6 pieces/panel) 6 sets (1 set / panel) 6 sets (1 set / panel) 6 sets (1 set /panel) 33 kV, 1,250 A, 25 kA - 3 sec. 33 kV, 1,250 A 33 kV The CT ratio depends on the load (double ratio), 15 VA or more, Class 0.5/5P20 Multifunction meter (voltage, current, active power, reactive power) , voltage detection device

<table>
<tr><th>No.</th><th>Description</th><th>Specifications</th></tr>
<tr><td></td><td>2) Protective relay

(6) Lightning arrester
(7) Cable connection unit</td><td>50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 79 (AC reclosing relay), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc.
To install at the 33 kV outgoing feeder
1) XLPE cable, 2 x 1c - 630 mm^2/phase
2) To provide an insulating plug for unused terminals
Table Access point of feeder
<table>
<tr><th>Feeder</th><th>Qty</th><th>Capacity</th></tr>
<tr><td>Apapa Main-1</td><td>1</td><td>15MVAx2</td></tr>
<tr><td>Apapa Main-2</td><td>1</td><td>15MVAx1</td></tr>
<tr><td>Tincan Island</td><td>1</td><td>7.5MVAx1</td></tr>
<tr><td>Navel Base</td><td>1</td><td>2.5MVAx1</td></tr>
<tr><td>Apapa Local (TR 1)</td><td>1</td><td>30MVA</td></tr>
<tr><td>Apapa Local (TR 2)</td><td>1</td><td>30MVA</td></tr>
</table></td></tr>
<tr><td>AR4-3-1</td><td>33 kV Bus coupler (CB) GIS
1. Construction
(1) Circuit breaker
(2) Disconnector
(3) Grounding device
(4) Current transformer
(5) Measurement and protection
2. Specification
(1) Circuit breaker
(2) Disconnector
(3) Grounding device
(4) Current transformer
(5) Measurement and protection
1) Protective relay</td><td>

1 unit (1 unit/panel)
1 unit (1 unit/panel)
1 unit (1 unit/panel)
3 pieces (3 piece/panel)
1 set (1 set/panel)

33 kV, 2,000 A, 25 kA - 3 sec
33 kV, 2,000 A
33 kV
2,000/1 A, 15 VA or more, Class 5P20
50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 25 (Synchronizing or synchronism-check), 86 (Lockout relay), 95 (Trip circuit supervision relay), etc.</td></tr>
<tr><td>AR4-3-2</td><td>33 kV Bus coupler (Bus riser) GIS
1. Construction
(1) Disconnector
(2) Grounding device
(3) Cable connection unit
(4) 33 kV Bus riser GIS
(for future expansion)
2. Specification
(1) Disconnector
(2) Grounding device
(3) Cable connection unit
(4) 33 kV Bus riser GIS
(for future expansion)
3. Other notice</td><td>

1 unit (1 unit/panel)
1 unit (1 unit/panel)
1 set (1 set/panel)
1 set (1 set/panel)

1) 33 kV, 2,000 A
3) 33 kV
4) 2,000 A
To provide a connection for future expansion

1) To provide voltage detection device 33 kV Bus coupler (Bus riser) GIS
2) To provide voltage detection device 33 kV Bus riser GIS (for future expansion)</td></tr>
<tr><td>AR4-4</td><td>33 kV Voltage transformer GIS
1. Construction
(1) Instrument transformer
(2) Measurement and protection</td><td>

6 (3 piece/panel)
2 set (1 set/panel)</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th><th>Specifications</th></tr>
<tr><td></td><td>2. Specification
(1) Instrument transformer
(2) Measurement and protection
1) Measurement
2) Protective relay</td><td>
33/√ 3 kV, 110/√ 3 V, 110/3 V, 50 VA or more, Class 0.5/5P20

Voltage
50/51 (Instantaneous and time overcurrent relay), 50/51N (Instantaneous and time ground fault relay), 27 (Under voltage relay), 86 (Lockout relay), etc.</td></tr>
<tr><td>AR4-5</td><td>33 kV Power cable
1. Construction
(1) 33 kV Power cable
(2) Terminal connection box
2. Specification of 33 kV Power cable
(1) Applicable standard
(2) Type
(3) Conductor
(4) Metallic screen
(5) Water tightness
(6) Outer sheath
(7) Cable size

2. Specification of Terminal connection box
(1) Applicable standard
(2) Type
(3) Minimum creepage distance
(4) Partial discharge

3. Replacement parts
(1) Terminal connection box (various on the transformer side)
(2) Terminal connection box (various on the switchgear side)
4. Other notice</td><td>

3,360 m
90 pieces

IEC, JEC, JIS, JEM or equivalent standard
XLPE cable
Compressed copper stranded wire
Copper tape
Water blocking tape
Polyvinyl chloride (or polyethylene)
Table Cable size<table><tr><th>From</th><th>To</th><th>Cable size</th></tr><tr><td>132/33 kV Transformer</td><td>33kV GIS</td><td>2 x 1c-630mm^2 x 3 phase</td></tr><tr><td>33kV GIS</td><td>33 kV Ring main unit</td><td>1c-630 mm^2 x 3 phase</td></tr><tr><td>33kV GIS</td><td>33/11 kV transformer</td><td>1c-630 mm^2 x 3 phase</td></tr><tr><td>132/33 kV Transformer</td><td>Grounding transformer</td><td>1c-240 mm^2 x 3 phase</td></tr><tr><td>Mobile transformer</td><td>Existing 33kV switchgear</td><td>1c-630 mm^2 x 3 phase</td></tr></table>IEC, JEC, JIS, JEM or equivalent standard
XLPE cable, outdoor
31.5 mm/kV
5 pc or less

3 pieces

3 pieces

To install inside corrugated hard polyethylene pipe in pit</td></tr>
<tr><td>AR4-6</td><td>33 kV Ring main unit
1. Construction
(1) 33 kV Ring main unit
2. Specification
(1) Applicable standard
(2) Load switch
(3) Grounding device
(4) Cable connection unit</td><td>

4 units

IEC, JIS, JEC, JEM or equivalent
33 kV, 1,250 A, 25 kA (with fuse)
33 kV
2 x 1c - 630 mm^2/phase
Table Access point of feeder<table><tr><th>Feeder</th><th>Qty</th></tr><tr><td>Apapa Main 1</td><td>1</td></tr><tr><td>Apapa Main 2</td><td>1</td></tr><tr><td>Tincan</td><td>1</td></tr><tr><td>Navel Base</td><td>1</td></tr></table></td></tr>
</table>

No.	Description	Specifications
	(5) Accessories	ODA plate or sticker
AR5 AR5-1	**Other incidental facilities** **DC 110 V Power supply system (regular-use and standby type including DC distribution board)** **1. Construction**	
	(1) DC Power supply unit	1 set
	(2) DC Distribution board	1 set
	2. Specification of DC Power supply unit	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent standard
	(2) Type	Indoor, metal enclosed type, thyristor system
	(3) Input power source	Grounding transformer, Emergency generator
	(4) Configuration	1) It consists of two chargers and two batteries and operates as regular-use and standby respectively. 2) When one unit fails, it should be automatically transferred to the healthy one.
	(5) Input voltage	3-phase 4-wire system, AC 415/240 V ± 10%
	(6) DC output voltage	1) To adjust the output voltage of DC 110 V (± 3 V) by load voltage compensation device (silicon dropper etc.) 2) DC 48 V for power supply of central monitoring system and software is converted by converter etc.
	(7) Rating	100% continuously
	(8) Rated output current	50 A (to submit a calculation sheet)
	(9) Battery	Valve-regulated stationary lead-acid battery, 200 Ah/10 h, 54 cells (to submit a calculation sheet)
	(10) Accessories	Ammeter, Voltmeter, Under voltage relay, Overcurrent relay, Ground fault relay, Fault Indicator, MCCB with alarm contact, Load voltage compensation device, ODA plate or sticker, etc.
	3. Specification of DC Distribution board	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	Indoor type, metal enclosed type
	(3) Rated input voltage	DC 110 V
	(4) Power division	1) To divide power source for each power supply circuit appropriately 2) To provide a spare circuit with MCCB in 20% or more of the number of circuits
	(5) Accessories	Panel lighting, MCCB with alarm contact, ODA plate or sticker, etc.
	4. Replacement parts	
	(1) MCCB (various)	1 piece
	(2) Meter (various)	1 piece
	(3) Lamp (various)	100%
	(4) LED lamp (various, with socket)	10%
	(5) Fuse (various)	1 piece
	5. Other notice	1) Two storage batteries system are prepared with the same capacity and the back-up power is supplied by an emergency power generator. 2) The charger and storage battery system operates one as regular-use and the other as standby. 3) Even if the regular-use one breaks down, the standby complements all operation. 4) The capacity of the storage battery is for 3 hours at least after power failure.

No.	Description	Specifications
		5) The terminal block for control cables in on board, it is necessary to provide a spare of 10% or more of the quantity. 6) To install an insect repellent net on the opening
AR5-2	**AC Power supply system (regular-use and standby type including DC distribution board)**	
	1. Construction	
	(1) Station service AC power supply panel	1 set
	(2) AC Distribution panel	1 set
	2. Specification of Station service AC power supply panel	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	Indoor type, self-supporting vertical type, regular-use and standby type
	(3) Installation	3rd floor of control building, indoor
	(4) Rated voltage	415-240 V
	(5) Rated capacity	200 kVA
	(6) Rated frequency	50 Hz
	(7) Number of phases	3 phase
	(8) Changeover switch	To receive power from two grounding transformers and emergency generator and operate in regular-use and standby by changeover switch automatically
	(9) Spare circuit	To provide a spare circuit with MCCB in 20% or more of the number of circuit
	(10) Current transformer	1) 400/1 A, 15 VA, Class 1.0 2) To install at the secondary side of grounding transformer (in common use of station service transformer) and the output side of emergency generator
	(11) Voltage transformer	1) 440/√ 3 V, 110/√ 3 V, 50 VA, Class 1.0 2) To install at the secondary side of grounding transformer (in common use of station service transformer) and the output side of emergency generator
	(12) Accessories	Panel lighting, energy meter, under voltage relay, overcurrent relay, ground fault relay, fault indicator, MCCB with alarm contact, voltmeter, ammeter, ODA plate or sticker, etc.
	3. Specification of AC Distribution panel	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent
	(2) Type	Indoor type, metal enclosed type
	(3) Installation	3rd floor of control building, indoor
	(4) Input	AC 415/240 V ± 5%, 3-phase 4-wire system
	(5) Output	3 phase AC 415 V and single phase AC 240 V
	(6) Accessories	ODA plate or sticker, etc.
	4. Replacement parts	
	(1) MCCB (various)	1 piece
	(2) Meter (various)	1 piece
	(3) Lamp (various)	100%
	(4) LED lamp (various, with socket)	10%
	(5) Fuse (various)	1 piece
	5. Other notice	1) Spare terminal block shall be provided at 10% or more of the quantity as for terminal block of control cables in the panel. 2) To install an uninterruptible power supply system to prevent instantaneous blackouts as for AC loads (SCADA, recorder, etc.) that should avoid instantaneous power failure

No.	Description	Specifications
AR5-3	**Substation earthing**	
	1. Construction	
	(1) Substation ground equipment	1 set
	(2) Lightning protection equipment	1 set
	2. Specification of Substation ground equipment	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent
	(2) Grounding method	Mesh grounding type with coupling type grounding rod
	(3) Materials	
	1) Grounding wire	Annealed copper wire (A) or equivalent
	2) Insulated ground wire	Polyvinyl chloride wire (IV) or equivalent
	3) Grounding rod	Coupling type copper-coated steel rod D14-1500 mm of two coupling or equivalent
	4) Connection material	T type compression connector or bolt connector or equivalent
	3. Specification of Lightning protection equipment	
	(1) Applicable standard	IEC, JIS, JEC, JEM or equivalent
	(2) Lightning rod	1) To prevent direct lightning stroke to substation equipment 2) Aluminum made (300 mm) or equivalent, if necessary, build a self-supporting pole on the roof of the control building.
	(3) Others	1) Materials for connection with lightning protection materials. 2) Materials for connection to existing earthing networks 3) Materials for connection with existing equipment (grounding wire, connecting terminal, etc.)
	4. Other notice	Connect to the existing grounding system.
AR5-4	**Grounding transformer (in common use of station service transformer)**	
	1. Construction	
	(1) Grounding transformer (in common use of station service transformer)	2 Units
	2. Specification	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	Outdoor type, no-load tap changer, sealing type
	(3) Installation	Outdoor
	(4) Rated voltage	Primary voltage: 33 kV Secondary voltage: 415-240 V
	(5) Rated capacity	200 kVA
	(6) Rated frequency	50 Hz
	(7) Number of phases	3 phase
	(8) Cooling method	Oil-immersed oil natural air natural type
	(9) Connection method	ZNyn11
	(10) No-load tap changer	
	1) Tap voltage	33 kV ± 5%
	2) Number of taps	5 taps
	3) Step voltage	2.5%
	(11) Painting	Heavy-duty salt-resistant paint finish (paint color: N7 or RAL 7033)
	(12) Accessories	1) Cable duct on both of the primary side and secondary side 2) Oil level gauge 3) Oil temperature gauge, 4) 33 kV outdoor disconnector 5) ODA plate or sticker, etc.
	3. Other notice	To provide fire wall and oil-proof dike with drain and valve

No.	Description	Specifications
AR5-5	**Emergency generator**	
	1. Construction	
	(1) Emergency generator	1 Unit
	(2) Fuel tank	1 Unit
	2. Specification of Emergency generator	
	(1) Applicable standard	IEC, JEC, JIS, JEM or equivalent standard
	(2) Type	Outdoor type, medium speed type diesel engine, unit type
	(3) Installation	Outdoor
	(4) Rated voltage	415-240 V
	(5) Rated capacity	50 kVA
	(6) Rated frequency	50 Hz
	(7) Number of phases	3 phase
	(8) Changeover switch	1) To detect received power and operate automatically at power failure. 2) To operate manually and automatically by changeover switch.
	(9) Spare circuit	To provide a spare circuit with MCCB with 20% or more of the number of circuit
	(10) Accessories	ODA plate or sticker, etc.
	3. Specification of Fuel tank	
	(1) Capacity	600 L
	(2) Others	Oil-proof dick with drain and valve
	4. Replacement parts	
	(1) Filter	1 piece
	(2) Lamp per	1 piece
	5. Other notice	1) Emergency generator is used for emergency AC power supply to substation equipment, emergency lighting, battery charging. 2) To provide a roof for emergency generator and fuel tank
AR5-6	**Overhead traveling crane**	
	1. Construction	
	(1) Overhead traveling crane	1 set
	2. Specification	
	(1) Applicable standard	Equivalent to JIS or international standard
	(2) Type	Overhead crane type
	(3) Rated voltage	415 V (3 phases) or 240 V (single phase)
	(4) Rated frequency	50 Hz
	(5) Rated load	5 t
	(6) Head	Approx. 7.3 m (To be determined by the tie-in dimension for loading and unloading of 132 kV GIS)
	(7) Span	Approx. 8.2 m (To be determined by the tie-in dimension for loading and unloading of 132 kV GIS)
	(8) Overall running length	Approx. 17.4 m (To be determined by the tie-in dimension for loading and unloading of 132 kV GIS)
	(9) Operation method	On-floor operation type with wired 6-point push button.
	(10) Hoisting machine	To provide a start shock absorber
	3. Accessories	ODA plate or sticker, etc.
	4. Other notice	1) 132 kV GIS can be carried in and out when 132 kV GIS is under maintenance. 2) Traveling rail, saddle, geared motor, girder and hoisting machine, etc.

No.	Description	Specifications
AR5-7	**Others, control cables etc.** **1. Construction** (1) Power cable (2) Control cable (3) Wiring material, terminal, etc. (4) Cable tray (5) Steel material for supporting cable (6) Corrugated hard polyethylene pipe with accessories **2. Specification** (1) Applicable standard	 1 set 1 set 1 set 1 set 1 set 1 set 1) IEC, JIS, JEC, JEM or equivalent
AK1-1	**132 kV Transmission gantry** **1. Construction** Gantry facilities **2. Specification** (1) Applicable standard (2) Type (3) Steel material (4) Transmission line **3. Accessories**	 2 units (2 units/set) IEC, JIS, JEC, JEM or equivalent Gantry type High strength steel, Hot-dip galvanizing 1) 132kV, ACSR (Bear, 250 mm^2), 1 circuit 2) Phase segregation is 4 m or more. 3) The interval between the gantries is approx. 50 m, the location of gantry is determined by consideration f tension of transmission line. ODA plate or sticker, etc.
Ak1-2	**132kV Transmission line material** **1. Construction** (1) 132kV transmission line facilities **2. Specification** (1) Applicable standard (2) Transmission line (3) Length of overhead line (4) Insulator and Accessories	 1 set IEC, JIS, JEC, JEM or equivalent ACSR (Bear, 250 mm^2), 1 circuit Approx. 300 m (100m x 3 lines) 1) Insulator 2) Anchor clamp 3) Jumper line

Test and Maintenance Equipment

No.	Description	Specifications
MT-1	**Vacuum transformer oil purifier** **1. Component** (1) Vacuum oil purifier **2. Specification** (1) Applicable standard (2) Rated value frequency (3) Oil processing ability (4) Accessories	 1 unit IEC, JEC, JIS, JEM or equivalent standard 50/60 Hz 4,000 L/h ODA plate or sticker, etc.

No.	Description	Specifications
MT-2	**Transformer oil breakdown voltage tester** **1. Component** (1) Insulation tester **2. Specification** (1) Applicable standard (2) Power source (3) Output voltage (4) Accessories	 1 unit IEC, JEC, JIS, JEM or equivalent standard 3 phases, 400 V, 50 Hz 0 to 60 kV ODA plate or sticker, etc.
MT-3	**Protection relay tester** **1. Component** (1) 132 kV Blocking coil **2. Specification** (1) Applicable standard (2) Rated value frequency (3) Current adjustment range (4) Voltage adjustment range (5) Accessories	 1 unit IEC, JEC, JIS, JEM or equivalent standard 50/60Hz 0 to 50 A 0 to 300 V ODA sticker, etc.
MT-4	**SF_6 Gas handling unit for GIS** **1. Component** (1) SF_6 Gas handling unit for GIS **2. Specification** (1) Applicable standard (2) Rated value frequency (3) SF_6 gas filling ability (4) SF_6 gas suction ability (5) Accessories	 1 unit IEC, JEC, JIS, JEM or equivalent standard 50/60 Hz 5.7 m3/h or more 5.2m3/h or more ODA plate or sticker, etc.
MT-5	**Power measurer** **1. Component** Mobile power analyzer **2. Specification** (1) Applicable standard (2) Measurement (3) Attachment (4) Accessories	 1 unit IEC, JEC, JIS, JEM or equivalent standard Measuring of power, voltage, frequency, active power, reactive power, electric energy, phase, power factor To attach voltage, electric power detection clamp ODA sticker, etc.
MT-6	**Stand for working at heights** **1. Component** Stand for working at heights **2. Specification** (1) Working heightr (2) Type (3) Height of work floor (4)capacity (5)Handrail of work stand (5) Accessories	 1 unit 4.5m Manual winch typed elevating work stand 4,5 m One person Equipped ODA plate or sticker, etc.

2-2-2-2-3 The Control Building for Substation

(1) Calculation of size of Apapa Road Substation facilities

The building standard in Nigeria is based on "National Building Code (2006) (hereinafter referred to as NBC) following "British Standard". In the Project, design documents will be submitted to TCN, and TCN will apply for approvals to the related organizations and obtain their approvals. Therefore, designing of facilities with secured safety and functionality should be proceeded as reference to NBC and Japanese building standard.

In designing of facilities in the Project, surface of land and geological survey will be executed, and the depth will be set so that long-term allowed bearing value of supporting layer can be obtained. Pile foundation is considered to be adopted when the supporting layer is found to be deep as result of surface and geological survey. Moreover, design will be also based on the current status of building technology in Nigeria.

Facility design conditions is shown Table 2-2-12 and Table 2-2-13.

Table 2-2-12 Building Design Load (Japan Architectural design Standard)

Fixed Load	Actual weight of Main frame construction and finishing materials		
Lived Load	Room	For floor (N/m^2)	For structure (N/m^2)
	Roof	1,000	600
	Control room (3F)	4,900	2,900
	33 kV GIS room (2F)	16,000	12,000
	33 kV Cable room (MF)	2,900	2,600
	132 kV GIS room (GF)	10,000	8,000
	132 kV Cable room (BF)	2,900	2,600
Reference Wind Speed	31.1m/s		

[Source] JICA Mission

Table 2-2-13 Facility Design Conditions

Item	Contents	Details
Base structure	Reinforced concrete mat structure Selection of reinforced concrete foundation pile	Design strength (Fc) : 24 N/mm^2
Depth of foundation	GL-3.25 m	Long-term allowable bearing capacity : 150 kN/m^2
Upper structural skeleton	Reinforced concrete building with rigid frame structure Concrete block curtain wall	Design strength (Fc) : 24 N/mm2 Concrete block compressive strength : 4N/mm^2
Building area	about 230m^2	
Gross floor area	about 1,070m^2	5 floors including basement floor
Maximum height	about 21m	Consideration for lightning rod

[Source] JICA Mission

The building is considered to be the facility which is possible to drain in spite of invasion of rainwater from cable trench connected by means of the installment of rainwater pits and infiltration inlets.

(2) Layout Plan of Facilities

New facilities cannot help being installed at the limited narrow area because the existing substation facilities are placed in narrow spaces of Apapa Road Substation. Especially during the construction period, the construction plan is necessary to be made so that work flow line at construction, carriage of equipment and materials, and carrying vehicle are fully considered in order to evade contact or shock hazard because existing transformers and overhead transmission lines are activating.

2-2-3 Outline Design Drawing

Refer to the Appendix 5.

2-2-4 Construction/Procurement Plan

2-2-4-1 Construction/Procurement Policy

The transportation of procured equipment and materials from Japan to Nigeria is mainly by sea. Also, inland transportation occurs no specific problem because it is about 2 km from Lagos discharging port to the Project site. The local construction period should be planned under full consideration of the following matters.

(1) It is important to grasp in advance the contents of maintenance of existing facilities, implementation schedule and period of time etc., so that there will occur no problem in the operation and maintenance management and also the function of existing facilities.

(2) It is considered that civil work and concrete work etc. to be executed in the time except rainy season should be performed during the time except from May to September when it rains most in the year while dry season, period of rainy season and rainfall in and around the Republic Capital area are grasped in advance from the past records.

(3) A half of Nigeria's population are Muslim, and Islamic practices including the one-month long Ramadan (once a year) and religious exercise during working hours may lead to a fall in the work efficiency. The construction schedule must be made in the light of these factors.

2-2-4-2 Implementation Conditions

(1) Construction Situation in Nigeria and Technology Transfer

In Nigeria, while it is possible to find workers (laborers) for construction works, there are not many engineers or skilled technicians with expertise in construction process, quality or safety control. Therefore, the Japanese contractor should dispatch engineers or skilled technicians to Nigeria when necessary.

(2) Use of Local Equipment and Materials

132 kV GIS, 132/33 kV transformers, 33 kV GIS, and 132 kV cables etc. shall be procured from Japan as they need to withstand local weather conditions and operation by TCN for a long period of time. On the other hand, as construction equipment and materials for equipment foundations can be locally procured, local vendors, equipment and materials shall be actively utilized.

(3) Safety Measures

Since the sites of the Project has poor public security in Lagos city, attention shall be paid to the latest security information and costs for such safety measures as deployment of armed police and vehicle allocation planning shall be properly included in the budget for the project implementation.

(4) Tax Exemption

For customs clearance and duty exemption for equipment and materials procured for the Project, the contractor will have to submit application in advance to the Federal Ministry of Finance (FMF) via the FMPWH. According to FMPWH, the responsible organization of the Project, the exemption will be carried out as complete exemption, not as prior tax refund; that is, there will be no tax payment.

2-2-4-3 Itemization of Work/Procurement and Installation

The detailed undertakings for the Japanese side and Nigerian side for the implementation of the Project is shown in Table 2-2-14.

Table 2-2-14 Undertakings for Each Government

No.	Undertaking	To be covered by		Note
		Japanese side	Nigerian side	
1	The site for the installation of mobile substation ・Acquisition of site for installation of mobile substation (Renting Mobile's site) ・Removal of existing fences for carrying in passage of mobile substation ・Installation of gate door in carrying in passage		○	
2	Installation of mobile substation		○	
3	Deployment of guards at mobile substation		○	
4	Ground levelling and removal obstacles in the Project site (1)Apapa Road Substation ・Container, equipment, car, birdhouse, foundation, mango trees,etc. ・Transfer of existing 33kV cables (2)Akangba Substation ・Bush cutting and ground levelling		○	
5	Installation of temporary storage yard for equipment and facilities and of fences and gates ・Akangba Substation ・Railroad site next to Apaparoad Substation		○	
6	Appropriate storage and safety control for materials and equipment at temporary storage yard	○		
7	Temporary outage during construction		○	
8	Response to and compensation for users of electricity in relation to outages inevitable for the construction		○	
9	Announcement of outage plans and safety measures to users of electricity during the construction		○	

No.	Undertaking	To be covered by		Note
		Japanese side	Nigerian side	
10	Switching of charging of existing 132kV transmission line (at jumper line connecting part) ・Apapa Road – Ijora transmission line ・Akangba – Apapa Road transmission line (of 2 circuits, only 1 circuit is stopped for charge, and the other circuit is used for power supply)		○	
11	Securing of parking during the work		○	
12	Installation of office for construction work	○		For Japanese Contractor
13	Provision of places to dispose of surplus soil and waste water		○	
14	Manufacturing and procurement of materials and equipment	○		
15	Installation of materials and equipment, coordination and test	○		
16	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products			
	(1) Marine transportation of the Products from Japan to Nigeria	○		
	(2) Tax exemption and custom clearance of the Products at the port of disembarkation		○	
	(3) Internal transportation from the port of disembarkation to the project site	○		
17	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		○	
18	Measures necessary to obtain entry permits		○	
19	Appropriate operation and maintenance for facilities and equipment		○	
20	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		○	
21	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A			
	(1) Advising commission of A/P		○	
	(2) Payment commission		○	
22	Measures necessary to obtain the following permits: ・Permits for installation work ・Permits to access to restricted areas		○	
23	Installation work (1) Substation facilities and foundation (2) Installation work of materials and equipment, coordination and test (3) Safety fences in construction area (4) Access road to Project site	 ○ ○ ○	 ○	
24	Switching between mobile substation and existing substation		○	
25	Removal of existing grounding transformer		○	
26	Ground levelling and removal obstacles in the Project site (1)Apapa Road substation ・Existing 132/33kV transformer and firewall ・Existing tentative switch gears and control hut ・Removal of underground facilities (cable pit)		○	
27	Removal of existing emergency generator		○	

No.	Undertaking	To be covered by		Note
		Japanese side	Nigerian side	
28	Confirmation and ensuring of ground resistance value (1Ω or below) for existing grounding devices ・Akangba Substation ・Apapa Road Substation		○	
29	Provision of power source for procured control and protect display		○	
30	Installation of lights for procured equipment	○		
31	Initial operation guidance and operational guidance for maintenance and management of equipment procured	○		
32	Securing of the safety of persons concerned with the project at the project sites		○	
33	Construction work of control building at Apapa Road Substation	○		Foundation for transformer etc., shed for emergency generator, and exterior construction
34	Construction work of gantry foundation	○		
35	Removal of mobile substation and construction of new fences		○	
36	Hiring guard police for Japanese movement		○	
37	Appointment of the person in charge of implementation agency of the Project		○	
38	Instruction of operation and maintenance	○		

Note: The mark "○" shows the party in charge.
[Source] JICA Mission

2-2-4-4 Construction Supervision/Procurement Supervision Plan

Pursuant to Japan's Grant Aid system, the consultant shall form a consistent project team for detailed design and construction supervision in line with the intent of the basic design carried out in the outline design study so that the services will be carried out in an efficient manner. As the Project will involve construction works in substations that are being charged and supervision services should be provided in coordination with TCN and with great attention especially to safety, the consultant shall always have at least one engineer at the site at the stage of construction supervision to provide comprehensive supervision on process, quality, output and safety. For such processes as installation, commissioning and adjustment and delivery test, the consultant shall also dispatch other professional engineers to supervise such works conducted by the contractor. Moreover, Japanese specialists shall participate in observed inspection and inspection before shipment at equipment factories in Japan when necessary to prevent trouble after delivery of the equipment to the local sites.

(1) Basic Policy for Construction Supervision

As a basic policy, the consultant shall supervise progress of works to ensure that the works will be completed within the planned construction period and meet requirements in the contract concerning quality, output and delivery date of equipment and materials; and give supervision and guidance to the contractor to ensure that the works at the site will be carried out in a safe manner. The following are the major points to consider for construction supervision.

1) Process Management

The consultant shall cross-check the implementation schedule developed at the time of contracting and the actual progress either monthly or weekly so that the contractor will meet the delivery dates specified in the contract. In case delays are expected, the consultant shall remind the contractor and request submission and implementation of countermeasures so that works and delivery of equipment will be completed within the construction period specified in the contract. The planned schedule and the actual progress shall be cross-checked mainly in terms of the following items.

(i) Output (manufacturing work completed at equipment and material factories and amount of work completed at civil engineering work sites)

(ii) Delivery of equipment and materials (for transformation and civil engineering works)

(iii) Status of temporary works and preparation of construction equipment

(iv) Unit prices and actual number of engineers, technicians, laborers, etc.

2) Quality and Output

The consultant shall carry out the following management duties to check whether the manufactured/delivered/installed equipment and constructed facilities meet the quality and output requirements specified in the contract. In case quality or output is not likely to be ensured, the consultant shall immediately request the contractor to make corrections, changes or adjustments.

(i) Examination of manufacture drawings and specifications of equipment

(ii) Observation of equipment factory inspection or examination of the result of factory inspection

(iii) Examination of packaging, transportation and on-site temporary storage methods

(iv) Examination of execution drawings and installation instructions for equipment

(v) Examination of commissioning, adjustment, testing and inspection instructions for equipment

(vi) Supervision of equipment installation works at site and observation of commissioning, adjustment, testing and inspection

(vii) Cross-check of finished work quality with equipment installation drawings, manufacture drawings, and as-built drawings

3) Safety Management

The Project will be carried out on substations which will continue its operation even during the works to be borne by Japan side, safety management needs to be carefully considered such as securing the sufficient distance from power live parts, implementation of power outage work during night time. In consultation and cooperation with a supervisor of the contractor, the consultant shall conduct safety management to prevent industrial accidents and other accidents involving third parties at the site during the installation work period. Attention has to be paid to the following points for safety management.

(i) Establishment of safety management rules and appointment of a safety manager

(ii) Accident prevention with periodic inspection of construction machinery

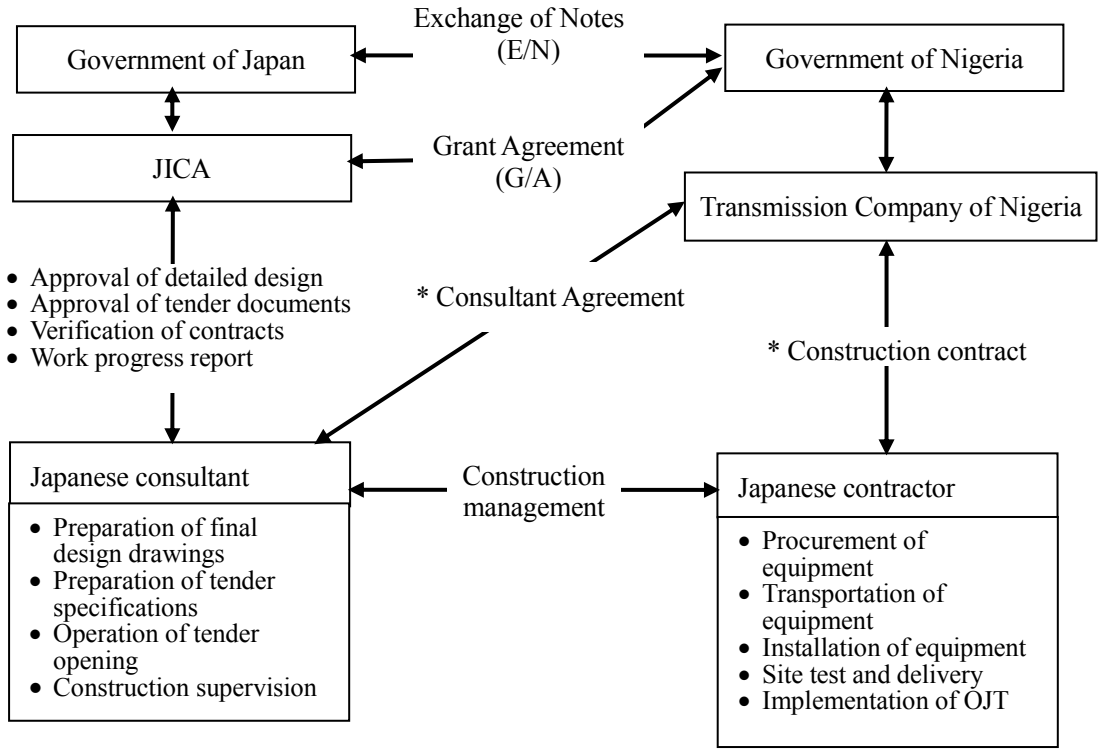
(iii) Establishment of traveling routes for construction vehicles, transporting machines, etc. and

thorough enforcement of safe traveling

(iv) Welfare benefits for workers and encouragement to take vacation days

(2) General Relationship concerning Project Implementation

Figure 2-2-17 shows relations of the parties involved in project implementation including construction supervision.



Note: *JICA's authentication is required for consultancy and vendor contracts.
[Source] JICA Mission

Figure 2-2-17 Relations of Parties Involved in the Project Implementation

(3) Construction Supervisor

The contractor shall conduct procurement and installation of the substation facilities for existing substations as well as foundation works (civil engineering works) for such works. The contractor will enter into a contract with local subcontractors in Nigeria, and local workers will carry out the works. As the contractor needs to ensure that local subcontractors will fully understand the requirements concerning the construction schedule, quality, output and safety measures specified in the contract, the contractor shall dispatch engineers with experience in similar overseas projects to provide guidance and advice to local subcontractors.

Considering the scale and contents of the substation facilities of the Project, it is preferable that engineers from the contractor will be present and engage in works at the site on a full-time basis, as shown in Table 2-2-15.

Table 2-2-15 Organization of the Contractor

Engineer to be dispatched	No. of personnel	Duties	Period of dispatch
Local procurement management personnel	1	Overall management of the works, consultation and coordination with relevant organizations and obtainment of approval, OJT implementation, equipment procurement management, customs clearance, labor management, and accounting, and management of equipment installation works at Apo Substation	Entire construction period
Operation and management engineer (Electrical safety)	1	Electrical safety control in installation work of materials and equipment	Period of equipment installation works
Operation and management engineer (Architecture)	1	Supervision of architecture and equipment foundation construction	Period of architecture and equipment foundation construction
Operation and management engineer (Facility)	1	Supervision of architecture facilities	Period of architectural equipment construction
Inspector	1	Confirmation and verification of equipment manufacture drawings, observation of testing, etc. for transforming equipment	Periods for drawing approval and equipment testing
Local procurement management sub-personnel (locally hired)	1	Miscellaneous duties	Entire construction period
Guard	About 3	Security for procured equipment, construction equipment, vehicles, etc.	From arrival of procured equipment to the completion of installation

[Source] JICA Mission

2-2-4-5 Quality Control Plan

Construction supervisors dispatched from the consulting company shall conduct the following supervision and verification work to see whether the contractor meets the requirements specified in the contract documents (technical specifications, execution drawings, etc.) in terms of quality of the procured equipment and output of construction and installation works. In case required quality or output is not likely to be achieved, the consultant shall immediately request the contractor to make corrections, changes or adjustments.

(1) Examination of shop drawings and specifications of equipment

(2) Observation of equipment factory inspection or examination of the result of factory inspection

(3) Examination of packaging, transportation and on-site temporary storage methods

(4) Examination of execution drawings and installation instructions for equipment

(5) Examination of commissioning, adjustment, testing and inspection instructions for equipment

(6) Supervision of equipment installation works at site and observation of commissioning, adjustment, testing and inspection

(7) Cross-check of finished work quality with equipment installation drawings, manufacture drawings

(8) Cross-check of finished work quality with construction execution drawings and manufacture drawings

2-2-4-6 Procurement Plan

As the equipment for substation facilities to be procured and installed in the Project is not produced in Nigeria, major units for the Project shall be Japanese products pursuant to the Grant Aid scheme. Such Japanese products shall be selected with due considerations to operability and maintainability of the equipment for Nigerian engineers and the availability of after-the-sale services such as procurement of spare items and response to failures.

Based on the above, the equipment to be used in the Project shall be procured as below.

(1) Items to Be Locally Procured

Construction equipment and materials including cement, fine/coarse concrete aggregates, reinforcing steel rods, wood materials, gasoline, diesel oil, construction vehicles, cranes, trailers, computers for operation management and other temporary equipment and materials

(2) Items to Be Procured from Japan

Major items for transformation including 132 kV GIS, 132/33 kV transformers and 33 kV GIS

(3) Items to Be Procured from Third Countries

33 kV cables

2-2-4-7 Safety Measures during Construction

Work should be performed based on the effect of "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects (September, 2014)" (hereinafter referred to as "Safety Management Guidance"). In formulating of implementation plan, Safety Management Guidance and Federal Republic of Nigeria National Building Code should be considered, and necessary safety measures should be taken.

In Nigeria conflicts and riots among different races, areas and religions, and riots and terror attacks by both Islamic extremists and anti-government armed organizations have occurred. Moreover, typical crimes frequently have happened owing to larger gap between rich and poor and proliferation of guns. That is why necessary safety measures such as deployment of guards and guard police and security of communication means and so on should be taken.

Although this area (around Lagos port) is not regarded as an especially dangerous area, at the preparatory survey, general local public gave advice that this place was dangerous because loading workers at land or sea

were stationed around. Therefore, guard police will be deployed during construction period of time.

2-2-4-8 The Plan for Initial Operational Guidance/Regular Operational Guidance etc.

As a basic rule, instructors from manufacturers shall give instructions before completion of works for initial operation of the procured equipment as well as regular operation and maintenance methods, using operation and maintenance manuals. For smooth implementation of such instructions, TCN shall have close communication and consultation with the consultant and subcontractors and appoint full-time engineers who will participate in the OJT. Appointed TCN engineers shall spread acquired skills to other members to cooperate for the improvement of TCN's maintenance skills. Use of local vendors for operation and adjustment and testing before and after installation would be difficult because such works will require specialists from the manufacturers with a certain level of expertise. Therefore, engineers shall be dispatched from Japan for quality control, technical guidance and process management.

2-2-4-9 Implementation Schedule

The implementation schedule is shown in Figure 2-2-18 based on Japan's Grant Aid system.

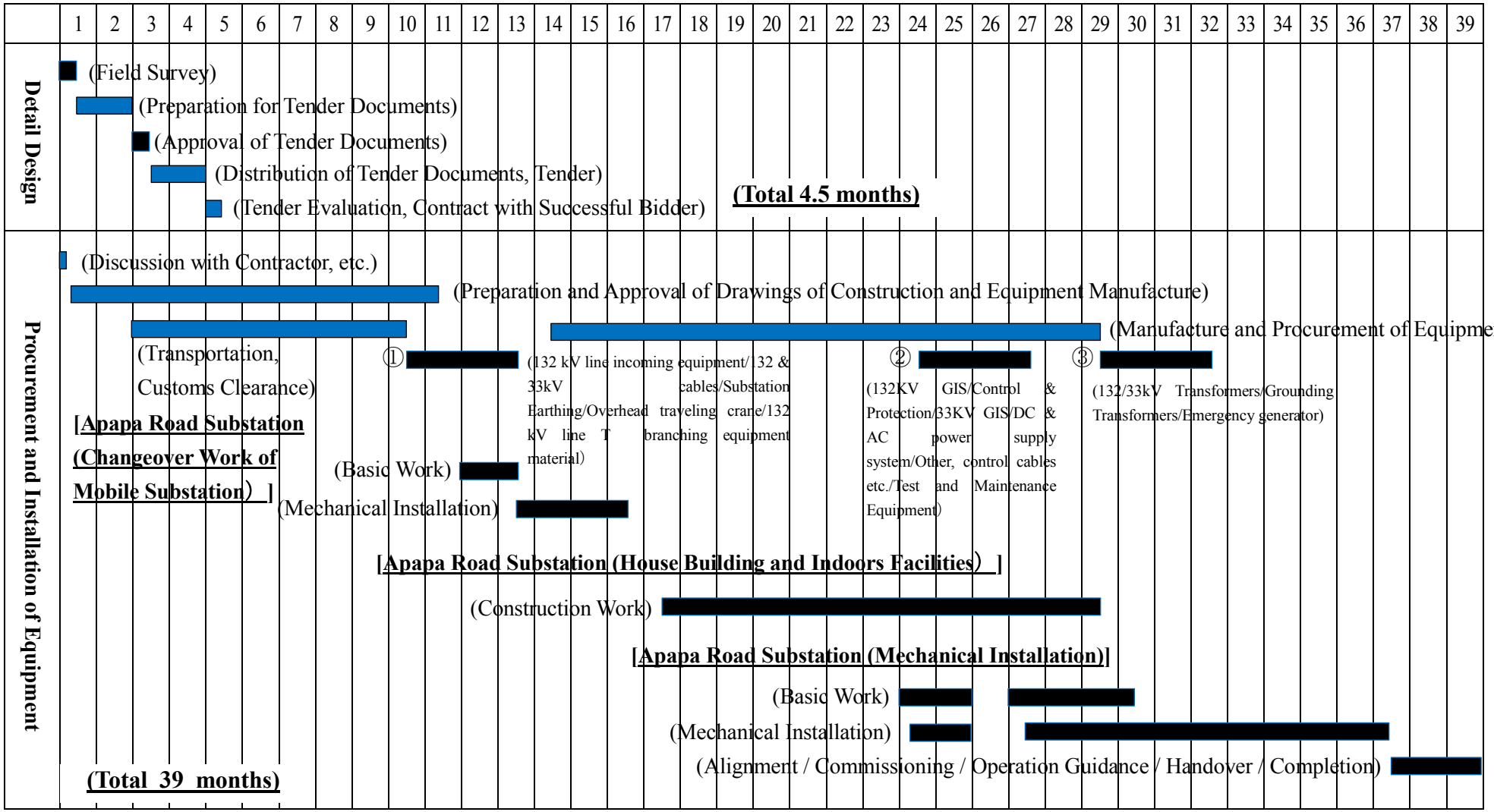


Figure 2-2-18 The Implementation Schedule

2-3 Outline of Works Allocated to Recipient Country

In implementing the Project, the work Nigeria side implements and the costs it bears are as follows;

Common Items

(1) Provision of information and data necessary for the Project

(2) Promptly the measures to unload, clear customs and implement tax exemption at ports in Nigeria of equipment and materials necessary for the Project

(3) Implementing tax exemption and provision of convenience for equipment and materials, and dispatched Japanese personnel necessary for the Project

(4) Implementing tax exemption for procurement of equipment and materials, Japanese corporations and Japanese personnel necessary for the Project

(5) Burden of opening account fees and commissions paid in authorized foreign exchange banks in Japan

(6) Burden of all costs necessary for implementation of the Project, which doesn't include grant aid of Japan

(7) Appointment to specialist engineers who transfer operation and maintenance skills in the Project, and confirmation of construction and observation to quality inspection during the construction period

(8) Appropriate usage and maintenance management of equipment &facilities which were built or procured under Japanese grant aid

(9) Compensation and acquirement of consensus to residents which are affected by rehabilitation of substations

(10) Publicity and contact of blackout plans to consumers during the construction period

(11) Environmental monitoring

Preparatory Construction

(1) Site Office, storage yard for equipment and materials (the site of railroad public company adjacent to Apapa Road Substation, and Akamba Substation), provision for nothing of temporary sites and securement of fences and gates

(2) Leveling of land necessary for upgrade of the substation

(3) Removal and relocation of wastes and unnecessary existing structures in the site of Apapa Road Substation and Akamba Substation

(4) Dismantling existing facilities and disposing equipment

(5) Acquiring construction site (site, access road, tentative storage yard for materials and equipment)

(6) Construction of fences and gates of substations

(7) Arrangement of furniture, equipment and fixtures in an electric room

(8) Maintenance of access roads after the construction of substations

(9) Installment, test operation/coordination, initial operation, daily operation of the communication lines for SCADA in Apapa Road Substation and Akangba Substation

(10) Repairing in case facilities (transmission lines, insulators, overhead lines, towers, and hardware, etc.) of transmission lines between Akangba and Apapa Road are in trouble

Construction burdened by Nigeria side

(1) Transfer, connection and changeover from existing substations to mobile substations

(2) Transfer and removal of existing underground facilities of existing power cables, existing control cables and so on

(3) Removal construction of existing transformers and existing tentative switching facilities

(4) Connection between existing transmission towers and existing service wires on the rooftop of the building in Apapa Road Substation

(5) Connection and changeover between new T-branch power lines and existing transmission towers/ existing gantries in Akanba Substation

(6) Connection between new 33/0.4 kV grounding transformers and existing 0.4 kV distribution facilities

(7) Connection and changeover between new 33 kV GIS and existing 33/11 kV transformers and existing 11 kV switchgears in coordination with Eko distribution company

2-4 Taxable Items and tax exemption procedures

2-4-1 Taxable items

In Japanese company (or Japanese people) implementing a construction project in Nigeria accompanied by import of equipment and materials, assumed taxable items, customs and other expenses are as follows;

(1) Companies Income Tax (CIT)

1) Tax Rate and Calculation Method

- Tax rate 30%.
- 30% tax is levied on all taxable profits of the entity.

2) Governing Law

Companies Income Tax Act Cap C21 LFN 2004 (CITA)

(2) Personal Income Tax

1) Tax rate and Calculation method

The rate is applied according to the following related income tax bands.

Fiest	NGN 300,000	7%
Next	NGN 300,000	11%
Next	NGN 500,000	15%
Next	NGN 500,000	19%
Next	NGN 1,600,000	21%
Above	NGN 3,200,000	24%

2) Governing Law

Personal Income Tax Act, Cap P10, LFN 2004, as amended

(3) Pension Contribution

1) Tax rate and Calculation method

Entity: 10% of employee's gross emolument
Employee: 8% of employee's gross emolument

2) Governing Law

Pension Reform Act 2014 (PRA)

(4) National Housing Fund (NHF) Contribution

1) Tax rate and Calculation method

2.5% of employee's basic salary

2) Governing Law

National Housing Fund Act 1992 (NHFA)

(5) National Health Insurance Scheme (NHIS) Contribution

1) Tax rate and Calculation method

Entity: Minimum of 10% of employee's basic salary
Employee: 5% of employee's basic salary

2) Governing Law

National Health Insurance Scheme (NHIS) Act 1999, National Health Insurance Scheme (NHIS)

Operational Guideline 2012

(6) Industrial Training Fund (ITF) Contribution

1) Tax rate and Calculation method

1% of annual payroll cost

2) Governing Law

Industrial Training Fund Act 2007, as amended (ITFA)

(7) Employee Compensation (EC) Scheme Contribution

1) Tax rate and Calculation method

1% of monthly payroll cost

2) Governing Law

Employee Compensation Act (ECA) 2010

(8) Value Added Tax (Output VAT: to be charged by entity)

1) Tax rate and Calculation method

5% of price of taxable item

2) Governing Law

Value Added Tax Act, CAP V1, LFN 2004, as amended (VATA)

(9) Value Added Tax (Input VAT: to be paid by entity on its purchases)

1) Tax rate and Calculation method

5% of price of taxable item

2) Governing Law

Value Added Tax Act, CAP V1, LFN 2004, as amended (VATA)

(10) Import Duty

1) Tax Rate and Calculation method

The rate is based on tariff classification of item being imported.
The rate the above of CIF value of item being imported

2) Governing Law

The 2015-2019 ECOWAS Common External Tariff, The Customs, Excise, etc. (Consolidation) Act No.4 1995, as amended (CETA)

(11) Port Development Levy

1) Tax Rate and Calculation method

7% of Import Duty

2) Governing Law

General Nigerian Import Guidelines

(12) Comprehensive Import Supervision Scheme Charge (CISS)

1) Tax Rate and Calculation method

1% of FOB value of imported item

2) Governing Law

General Nigerian Import Guidelines

(13) ECOWAS Trade Liberalisation Scheme (ETLS) Levy

1) Tax Rate and Calculation method

0.5% of CIF value of imported item

2) Governing Law

ECOWS Regulations

(14) Value Added Tax (Import)

1) Tax Rate and Calculation method

5% of summation of the CIF value of costs of importation item, and all taxes, duties and levies paid/payable outsider or by reason of importation into Nigeria

2) Governing Law

Value Added Tax Act. Cap V1, LFN 2004, as amended (VATA)

(15) Withholding Tax deducted from the entity's income

1) Tax Rate and Calculation method

5%. Deducted at the specified rate for payments to vendors or contractors

2) Governing Law

Companies Income Tax Act, Cap C21 LFN 2004 (CITA)

(16) Withholding Tax to be deducted by entity when paying its suppliers or venders

1) Tax Rate and Calculation method

- Computed on the income earned by the supplier
- The rate is classified according to the following kinds of contracts.

Table 2-4-1 Kind of Contract and Tax Rate

Kind of contract	Corporate Beneficiary	Individual Beneficiary
Dividend, Interest, Rent & Director's Fees	10	10
Professional Fees	10	5
Technical/Management/Royalty	10	5
Commission/Consultancy Fees	10	5
Construction	5	5
Other contracts	5	5

2) Governing Law

Companies Income Tax Act, Cap C21 LFN 2004 (CITA) and the Personal Income Tax Act, Cap P10, LFN 2004, as amended (PITA)

2-4-2 Tax Exemption Procedure

(1) Companies Income Tax (CIT)

1) Organization in charge

a) The Presidency, b) The Federal Ministry of Finance, c) The Federal Inland Revenue Services (FIRS)

2) Procedure

Presenting a written application to the Presidency through the Federal Ministry of Finance. In the application, the following would be provided.

a) Details of the project being undertaken in Nigeria
b) Specific justification for exemption
c) Any other relevant supporting document

After review of the application, the Presidency would make a decision and communicate same to applying entity.

3) Necessary duration

1 to 6 months

4) Tertiary Education Trust Fund :TETFA

A CIT exemption could be extended to cover TET exemption. However, for purpose of clarity, it is advised that a TET exemption is also requested alongside a CIT exemption.

(2) Personal Income Tax

1) Organization in charge

a) The Federal Ministry of Finance, b)The relevant SBIR (States Board of Internal Revenue) at the states where the employees would be tax resident

2) Procedure

Writing to the Minister of Finance with details of the project being undertaken in Nigeria and specific justification for the exemption of the employees from personal income tax

3) Necessary duration

1 to 6 months

(3) Pension Contribution

Currently, there are no specific mechanisms for an entity to obtain exemption for pension deductions and remittance obligations for its Nigerian employees. However, the Nigerian pension contributory scheme is optional for expatriate employees.

(4) National Housing Fund (NHF) Contribution

Currently, there are no specific mechanisms for an entity to obtain exemption for NHF deductions and remittance obligations for its Nigerian employees. However, in practice, an entity would not be required to register its expatriate employees for NHF contributions.

(5) National Health Insurance Scheme (NHIS) Contribution

Currently, there are no specific mechanisms for an entity to obtain exemption for NHIS deductions and remittance obligations for its Nigerian employees. However, in practice, an entity would not be required to register its expatriate employees for NHIS.

(6) Industrial Training Fund (ITF) Contribution

Currently, there are no specific mechanisms for an entity to obtain exemption for ITF contributions.

(7) Employee Compensation (EC) Scheme Contribution

Currently, there are no specific mechanisms for an entity to obtain exemption for EC scheme contributions.

(8) Value Added Tax (Output VAT: to be charged by entity)

1) Organization in charge

a) The Federal Ministry of Finance, b) The Federal Inland Revenue Service

2) Procedure

There are no specific mechanisms for an entity to obtain exemption for VAT registration.

3) Necessary Duration

N.A.

(9) Value Added Tax (Input VAT: to be paid by on its purchases)

1) Organization in charge

a) The Federal Ministry of Finance, b) The Federal Inland Revenue Service

2) Procedure

Writing to the Minister of Finance with details of the project being undertaken in Nigeria and specific justification for the exemption. Where the Minister is of the opinion that the circumstances are such as to render it expedient that such an exemption should be granted, the Minister may exempt the entity from paying VAT on purchases or imports. The Minister is required to ensure the notice for exemption is gazetted.

3) Necessary duration

1 to 6 months

(10) Import Duty

1) Organization in charge

a) The Federal Ministry of Finance, b) The Nigeria Customs Service (NCS)

2) Procedure

- There are 2 ways to obtain duty exemption (1) Under the Temporary importation (TI) regime or (2) Under the total duty exemption regime

- Temporary importation

  Under the TI regime, an entity could apply to the NCS to import goods into the country under the temporary import procedure. In this case, entity or the 3PL would require the following documents whilst declaring the items for import (i.e. before beginning importation of the item):
  - A bank guarantee from a reputable bank
  - Hire agreement or evidence of ownership
  - Details of project where items would be deployed
  - Technical manuals describing the items to be imported

- Covering Letter to NCS applying for TI approval
- A copy of the entity's and or 3PLor TI approvalportedtificate (or exemption status) for the past 3 years

Under the TI regime, items may remain in the country for a maximum of two years (i.e. an initial period of one year and two possible extensions for six months each), after which the guarantee would be released.

- Total exemption

An entity engaged in power transmission could apply for duty exemption pursuant to the provisions of CETA and the concessions provided under the 2016 FPM.

The entity would be required to submit a formal application to the Minister of Finance vide the ministry relevant to the item being imported to benefit from the concessions. The following are the documents required for a duty waiver application:

- Evidence of Registration with the Corporate Affairs Commission (Where applicable)
- The Memorandum of Understanding duly signed by the Minister of Finance or Minister of state for Budget and National planning between the donor agency and the Federal Government of Nigeria
- A proforma invoice indicating the value of imported items
- Other supporting documents which may be requested by the Ministry of finance

Where the Minister is of the opinion that the circumstances are such as to render it expedient that such an exemption should be granted, the Minister would exempt Japanese company from import duties on items related to the project.

Notwithstanding the foregoing, items imported from the ECOWAS region under the aegis of the ETLS shall be duty and quota free. The supplier would need to ensure it has obtain the relevant ETLS certificate (supporting the claim that the items have originated from the ECOWAS region) for the items being imported.

3) Necessary duration

3 to 12 months

(11) Port Development Levy

1) Organization in charge

The Nigeria Customs Service

2) Procedure

Under the total exemption regime, submitting a formal request to the responsible Ministry of the Project together with a proforma invoice indicating the value of imported items for the payment of CISS instead of the entity.

3) Necessary duration

1 to 3 months

(12) Comprehensive Import Supervision Scheme Charge (CISS)

1) Organization in charge

The Nigeria Customs Service

2) Procedure

The same as the above (11)

3) Necessary duration 1 to 3 months

(13) ECOWAS Trade Liberalisation Scheme (ETLS) Levy

1) Organization in charge

The Nigeria Customs Services

2) Procedure

Under the TI regime, it is common practice for the Nigeria Customs Services to grant full exemption from ETLS fees. However, companies intending to claim this exemption are required to obtain a bank guarantee from a local bank and there would be ancillary bank charges for obtaining a bank guarantee from a local bank and these charges vary from bank to bank.

Under the Total duty exemption regime, there is recognized to be nothing for a basis for obtaining exemption for ETLS levy.

3) Necessary duration

N.A.

(14) Value Added Tax (Import)

1) Organization in charge

a) Federal Ministry of Finance, b) The Federal Inland Revenue Service

2) Procedure

The entity is required to present a written application to the Minister of Finance with the details of the project being undertaken in Nigeria and specific justification for the exemption.

3) Necessary duration

1 to 6 months

(15) Withholding Tax (WHT) deducted from the entity's income

1) Organization in charge

a) Presidency, b) The Federal Ministry of Finance, c) The Federal Inland Revenue Service

2) Procedure

Company Income Tax exemption automatically exempts an entity from suffering WHT exemption.

3) Necessary duration

1 to 6 months

(16) Withholding Tax (WHT) to be deducted by entity when paying its suppliers or venders

1) Organization in charge

The Federal Inland Revenue Service

2) Procedure

There are no specific mechanism for obtaining exemption from deducting WHT upon payment to suppliers. However, an entity may write to FIRS (attaching supporting documents of its projects in Nigeria and importantly, an exemption letter from the Presidency from CIT liability) seeking exemption from WHT obligations.

3) Necessary duration

1 to 2 months

2-5 Project Operation and Maintenance Plan

2-5-1 Basic Policy (Implementation Structure, Personnel)

(1) Implementation Structure

Appropriate operation and maintenance(O & M) of transmission/substation facilities and environmental conservation around those facilities are indispensable for the improvement of power supply reliability to consumers in the target areas of the Project and the operation of stable power supply. For this reason, desirable are appropriate preventive maintenance and operation management targeting for lowering accidental rates of each facility and improving liability, safety and efficiency. Basic concept for maintenance management of transmission and substation facilities is shown in Figure 2-5-1. This figure shows that maintenance management of procured and installed equipment and facilities constructed in the Project should be implemented mainly by focusing on the way of preventive maintenance.

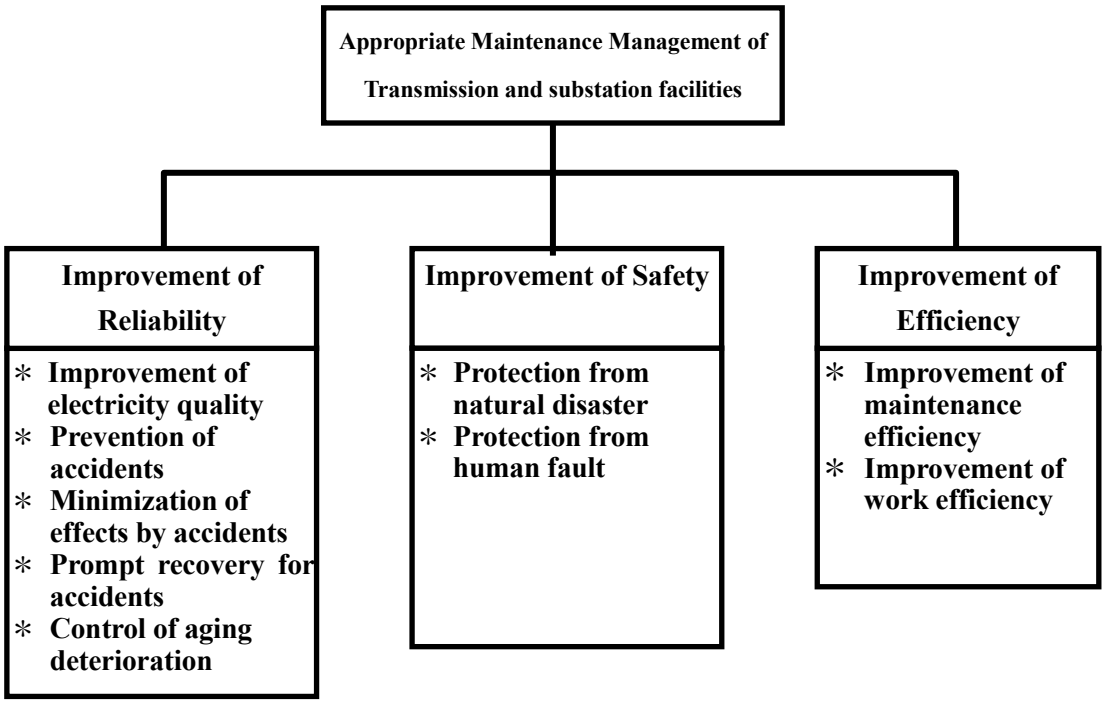


Figure 2-5-1 Basic Policy of Maintenance Management of Transmission and Substation Facilities

(2) Maintenance Management Organization Chart in Lagos area

As the maintenance management organization in Lagos area, Lagos Regional Office is generally in charge. Ajah Substation manages Apapa Road Substation.

Currently, 8 operators and 5 maintenance members are staffed in Apapa Road Substation.

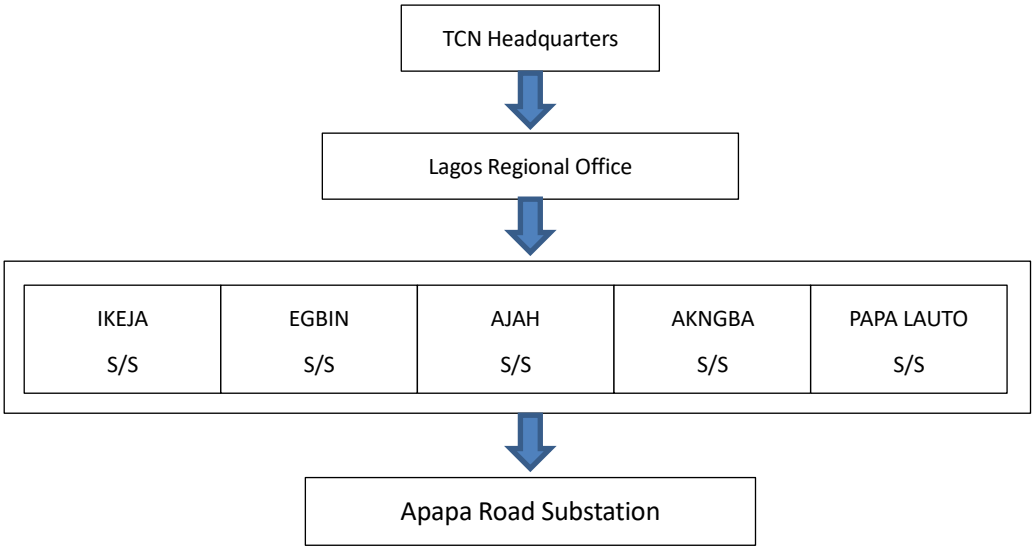


Figure 2-5-2 Maintenance Management Organization Chart in Lagos Area

2-5-2 Policy on Daily and Periodic Inspection

With experience in operation and maintenance management of power capacitors for stable transmission, TCN has a minimum knowledge and techniques concerning operation and maintenance management of the facilities. Therefore, the basic policy of the Project is to review checklist items for operation and maintenance management and reconfirm implementation schedule in order to ensure smooth and quick transition from guidance on initial and regular operations to the implementation of operation and maintenance management by TCN.

(1) Items of Daily and Periodic Inspection of Substation

Daily maintenance and inspection is crucial to sustainable operation of substation equipment including power capacitors, auxiliary facilities and protection control equipment to be installed in the Project. The following are the three major categories of inspection to be conducted by operation management personnel.

a) Examination and inspection at the time of completion of the substation equipment before start of operation

b) Daily inspection after commencement of operation

c) Periodic inspection after a certain period of operation

1) Items to be Checked for the Inspection at the Completion of Substation Facilities and for Periodic Inspection

Items to be checked for the inspection at the completion of substation facilities installation and those for periodic inspection are almost the same. Table 2-5-1 shows the items to be checked and measured. For examination and inspection at the completion of substation facilities installation, see 2-2-4-8 “Operation Guidance Plan”.

2) Daily Inspection

The substation facilities will require such operations as activation and release, like other substation facilities.

After it is confirmed that 132 kV system voltage has dropped and lagging reactive power has increased, the substation facilities shall be manually activated to stabilize such state. The substation facilities shall be manually released after it is confirmed that the system voltage has risen and delayed reactive power has lowered enough. As breakers and line switches with moving parts may have trouble during initial operation, operation status should be checked daily. Operation management personnel shall check all substation devices with a Japanese engineer who installed the equipment and learn about check points and keys to successful inspection.

Although the substation facilities can be remotely operated, daily inspection at the site is useful in detecting malfunctions immediately.

Daily inspection shall be conducted as visual inspection every day for a month after commencement of operation. After that, inspection shall be conducted about once a week. Table 2-5-1 shows the items to be checked.

Table 2-5-1 Items for Daily Checking

Device for inspection	Check item
Gas Circuit Breaker and isconnecting Switch	・ Dirt and breakage on surface ・ Corrosion and rusting of casing ・ Damage on external wiring ・ Confirmation of on-off display ・ Confirmation of gas pressure
Current Transformer and Condenser Type Voltage Transformer	・ Dirt and breakage on surface ・ Corrosion and rusting of casing ・ Damage on external wiring ・ Oil leakage
Lightning Arrestor	・ Dirt and Breakage on surface ・ Corrosion and rusting of casing ・ Damage on external wiring ・ Number of times of operation
Control panel and Relay panel	・ Corrosion and rusting of casing ・ Cleaning of vent filters ・ Indicating instruments and display ・ Installation environment (temperature)
Power cable and termination	・ Dirt and Breakage on surface
DC Supply System	・ Corrosion and rusting of casing ・ Buttery fluid leakage ・ Indicating instruments and display
Substation Earthing Device	・ Damage on wiring

[Source] JICA Mission

Operation management personnel shall keep daily inspection records whenever they conduct daily inspection.

After checking the daily inspection items listed in Table 2-5-1, operation management personnel shall describe inspection results in the book and keep it. Recording the results will help detect abnormal changes.

3) Periodic Inspection

Table 2-5-2 to Table 2-5-7 show the general items for periodic inspection and measurement. For periodic inspection, systems shall be shut down after a certain period of operation and inspection and measurements shall be conducted for the items listed in the table. Periodic inspection shall be conducted 1, 3, 6 and 12 years after the commencement of operation (and in another 6 and 12 years). Examination and inspection results shall be recorded and kept without fail.

Table 2-5-2 Items for Periodic Inspection of Gas Circuit Breaker

Device for inspection	Check item	Regular Inspection A	Regular Inspection B	Detailed Inspection A	Detailed Inspection B
		1 year	3 years	6 years	12 years
Gas Circuit Breaker	・ Inspection of structure and cleaning ・ Opening and closing operation test ・ Measurement of insulation resistance	○	○	○	○
	・ Inspection and Maintenance of attachment parts ・ Inspection and cleaning of blocking parts and support insulators ・ Inspection and lubrication of mechanism parts ・ Measurement of minimum operating voltage		○	○	○
	・ Measurement of operating pressure of gas density ・ Measurement of operating pressure of air pressure switches ・ Measurement of switching time ・ Measurement of resistance of main circuits			○	○

[Source] JICA Mission

Table 2-5-3 Periodic Inspection Items of Isolating Switch

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 year	6 year	12 year
Line Switch	・ Measurement of resistance of main circuits	○	○	○	○
	・ Inspection of structure and cleaning ・ Opening and closing operation test ・ Measurement of isolation resistance	○	○	○	○
	・ Inspection and maintenance of attachment parts ・ Inspection and deterioration check of arcing horns ・ Inspection and lubrication of active parts ・ Inspection of earthing wires and connecting parts		○	○	○

[Source] JICA Mission

Table 2-5-4 Periodical Inspection Items of Rheotrope/Transformer

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 year	6 year	12 year
Current Transformer and Condenser Type Voltage Transformer	・ Inspection, maintenance and cleaning of tanks, FT covers and oil level	○	○	○	○
	・ Inspection and cleaning of bushing and terminals ・ Measurement of insulation resistance	○	○	○	○
	・ Inspection of earthing wires and connecting parts		○	○	○
	・ Inspection of secondary and tertiary circuits ・ Inspection of coated parts		○	○	○

[Source] JICA Mission

Table 2-5-5 Items for Periodic Inspection of Lightning Arrestors

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 years	6 years	12 years
Lightning Arrestor	・ Inspection of external appearance and structure and cleaning ・ Inspection and cleaning of connecting parts of major circuits ・ Measurement of insulation resistance	○	○	○	○
	・ Inspection and cleaning of fastening parts of control circuits ・ Measurement of leaking currents			○ ○	○ ○

[Source] JICA Mission

Table 2-5-6 Items for Periodic Inspection of Protection and Control Panels

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 years	6 years	12 years
Capacitor Bank Protection Panel and Control Panel	・ External and internal inspection and cleaning of housing	○	○	○	○
	・ Inspection and cleaning of fan filters	○		○	○
	・ Inspection and cleaning of fastening parts control circuits ・ Inspection and maintenance of earthing conductors ・ Inspection of coated parts		○	○	○
	・ Replacement of fan filters			○	○
	・ Replacement of fuses (Ef.f. etc.)				○

[Source] JICA Mission

Table 2-5-7 Items for Periodic Inspection of DC Supply System

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 years	6 years	12 years
DC Supply System (Chargers)	・ Cleaning of fouling with dust ・ Check of various set values ・ Measurement of input/output voltage values and current values ・ Measurement of insulation resistance ・ Sequence test ・ Ventilation of housings	○	○	○	○
	・ Operation check of no-load voltage compensation circuits ・ Measurement of DC output current characteristics ・ Operation check of charge switching units and timers ・ Observation of output waveforms of rectifiers ・ Operation test at the time of automatic equalization and power return after power failure		○	○	○
	・ Characteristic verification test of silicon symmetrical switchers ・ Observation of voltage and waveforms of controlling circuits ・ Measurement of adjustable range of various charging voltages ・ Precise measurement of automatic constant voltage characteristics ・ Calibration of instruments			○	○
	・ Detailed inspection of parts and operation of each circuit and replacement of parts				○
DC Supply System (Batteries)	・ Measurement of voltage of all cells ・ Measurement of temperature and specific gravity of electrolyte of all cells	○	○	○	○
	・ Check of cracks and liquid leakage ・ Check of corrosion of terminals and connecting parts ・ Check of damage on low liquid alarm, sensors, etc. ・ Check of deformation, cracks and loss of inner electrodes ・ Check of quantity, turbidity and discoloration of electrolytic solution	○	○	○	○

Device for inspection	Check item	Regular inspection A	Regular inspection B	Detailed inspection A	Detailed inspection B
		1 year	3 years	6 years	12 years
	・ Check of damage of hydrometers and thermometers in liquid ・ Check and retightening of terminals and connecting parts ・ Check of deposition volume of active materials ・ Check of charging voltage at the time of floating charge ・ Execution of equalized charge				
	・ Capacity test ・ Adjustment of specific gravity of electrolytic solution (if necessary) ・ Activation of liquid replacement (if necessary)			Expected standard life duration (control valve type stationary lead batteries) MSE type: 7-9 years	Same as on the left

[Source] JICA Mission

2-6 Project Cost Estimation

2-6-1 Initial Cost Estimation of the Project

The total cost borne by Nigerian side for the Project under the Japan's Grant Aid scheme is ninety nine million eight hundred seventy thousand yen. The breakdown cost is the following table.

(1) Costs borne by Nigerian side

1) Apapa Road Substation

a) Land rental for mobile station and removal of fences 51,000 US$ (about 5.75 million yen)
b) Relocation of mobile station 9,000 US$ (about 1.02 million yen)
c) Removal working in the substation (container, vehicles, etc.) 40,000 US$ (about 4.51 million yen)
d) Relocation of existing 33 kV,11 kV cables 20,000 US$ (about 2.26 million yen)
e) Acquiring of temporary storage land for equipment & materials 13,000 US$ (about 1.47 million yen)
f) Switching working of 132 kV transmission line 1,000 US$ (about 0.11 million yen)
g) Switching working from substation to mobile station 10,000 US$ (about 1.13 million yen)
h) Removal working of existing grounding transformer 16,000 US$ (about 1.81 million yen)
i) Removal working hut for emergency generator 16,000 US$ (about 1.81 million yen)
j) Removal working of existing 132/33 kV transformer, firewall, temporary switching device 55,000 US$ (about 6.21 million yen)
k) Switching working from mobile station to new substation facilities 10,000 US$ (about 1.13 million yen)

l) Removal working of mobile substation and installment of new fences
23,000 US$ (about 2.60 million yen)

m) Guards (watch for mobile substation) 92,000 US$ (about 10.38 million yen)

n) Procurement for trading power meter 6,000 US$ (about 0.68 million yen)

o) Switching connection of 33 kV cable (6 feeders) 146,000 US$ (about 16.47 million yen)

p) Police (guarding for Japanese) 88,100 US$ (about 9.94 million yen)

2) Akangba Substation

a) Bush cutting work and leveling 45,000 US$ (about 5.08 million yen)

b) Grounding work of connection of 132 kV transmission line 9,000 US$ (about 1.02 million yen)

c) Fees for Bank Opening Account (B/A) and Agency Payment Fee (A/P)
30,000 US$ (about 3.38 million yen)

3) Payment of Taxes (CISS and ETLS) 205,000 US$ (about 23.13 million yen)

Costs borne by Nigerian Side 885,100 US$ (about 99.87 million yen)

(2) Conditions for Cost Estimation

1) Time of estimation: August 2017

2) Exchange rate: 1 USD = 112.83 JPN (average TTS from May to July 2017)

1 USD = 304.75 Naira (average TTB from May to July 2017)

3) Construction and procurement period: The period for detailed design, equipment procurement and installation is as shown in the construction schedule.

4) Other: The Project will be implemented according to Japan's Grant Aid scheme.

2-6-2 Operation and Maintenance Cost

The maintenance costs of the substation facilities procured in the Project (purchasing cost of spare parts and consumables) are about 1%/annum of equipment and materials costs in the rough estimated cost, and reach about US$ 127,000/annum. This amount is less than 1% of annual repairs cost of TCN (15,380,000 US$: 2014), and TCN will not have financial difficulties in operation and maintenance aspects.

CHAPTER 3 PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Preconditions in Implementing the Project

As a prerequisite of the site where new substation facilities will be constructed in the existing Apapa Road Substation site, the following preconditions should be necessary before the beginning of the Project implementation.

(1) Acquisition of land for installation of a mobile substation

The land for installation of a mobile substation should be rent from Mobil Oil Nigeria Plc., and also carry-in route of a mobile station is to be secured by removal of existing fences.

(2) Relocation of a mobile substation

A mobile substation located at another substation should be relocated to the Project site, and on transportation, necessary curing (extraction of insulating oils, and substitution of dry air for the prevention of insulating substances absorbing moisture, and so forth) should be also taken, and the states where operation is possible should be kept by vacuum degassing oiling of insulating oil and operation test after the relocation of a mobile substation is completed.

(3) Removal of existing obstacles and ground leveling

The existing obstacles (Containers, vehicles, foundations, hen houses, control panels, mango tree) which will hinder the start of the Project should be removed, and levelling of the site of installation of new substation facilities should be finished.

(4) Relocation of existing 33 kV/11 kV cables

The existing 33 kV/11 kV cables which will hinder the start of the Project should be relocated.

(5) Securing temporary stockyard for equipment and materials, and installing fences and doors with lock system

As temporary stockyard for equipment and materials, both the land for railroads behind Apapa Road Substation and the land in Akangba Substation should be secured. The temporary stockyard in Akangba Substation should be equipped with fences and doors with lock system.

3-2 Necessary Inputs by Recipient Country for Achievement of the Overall Project Plan

As follows are the inputs from the Nigerian sides that will be required to achieve the overall plan of the Project.

a) Daily operation and maintenance should be appropriately performed so that substation facilities procured and installed by Japanese side in the Project are made the most of.

b) It is necessary to be considered that the operation of overall power supply system should be initiated

smoothly by the deployment of operation and maintenance personnel of substation facilities constructed in the Project and the organized execution of education and training.

c) It is necessary that spare parts and expendables for maintenance of substation facilities constructed in the Project should be procured and supplemented without delay, and periodic maintenance should be surely performed.

d) It is necessary that serious accidents such as spread power system fault etc. of substation facilities should be prevented in advance by introduction and execution of preventive maintenance.

3-3 External Conditions

The main causes of frequent blackouts in the supply areas of the Project are the shortage of transformers capacity and breakdowns, aging substation facilities, one circuit of power transmission of Akangba - Apapa Road transmission line (without back-up function by two circuits of power transmission), and also the shortage of power supply by power stations. In the Project the upgrade of Apapa Road Substation will greatly contribute to improvement of power outages caused by both the Apapa Road Substation and Akangba-Apapa Road transmission line, but the power outages caused by power supply shortage of power stations will not be improved. This is why increase in supply power volume should be listed as outer condition to make the effect of upgrading the Substation appear to the maximum extent.

The real electricity generated is by far less than the installed capacities of power stations owing to the restrictions as follows a) to c).

a) Increase in gas supply volume as fuel of generators

b) Operating rates are reducing owing to breakdowns of generating facilities

c) Bill collection rates have been low and the financial conditions of power utility companies have worsened, and in the end, operations of power facilities have caused many problems. Thus, the following items are necessary for increase in supply capacity of power stations.

   i) Increase in gas supply volume through development of gas pipelines
   ii) Improvement of operation rates through appropriate operation and maintenance of generating facilities
   iii) Fiscal consolidation of power generation companies by improvement of bill collection rates of distribution companies

If these restraints are cleared, the total capacity of the power stations only around Lagos is forecasted to reach 3,700 MW (source: 2016 plan of TCN) in 2025, which will be about three times as large as at present.

3-4 Project Evaluation

3-4-1 Relevance

As shown below, the Project will contribute to the realization of Nigerian development plan and Nigerian Economic Recovery and Growth Plan, and bring benefits to the general public. Therefore, the relevance of the Project is considered high.

(1) Population of Benefits

Implementation of the Project will enable stable and good-quality electricity to be supplied to about 223 thousand residents in Apapa area (National Population Commission of Nigeria, 2006 census).

(2) Urgency

At present the function of 132 kV GIS at Apapa Road Substation has been completely halt owing to breakdown. Thus, as alternative of 132 kV GIS, gas insulators has been installed by temporally bypassing circuits, and the state of provisional power receiving has been continuing.

The substation has not played an ordinary role as substation because the substation has lacked the necessary facilities (protection devices, switching devices, meters and monitoring panels) and also it has lost power system protection function, monitoring control function and maintainability. In case an accident occurs inside or outside (transmission system) of Apapa Road Substation, the accident can cause injury or death or develop to large blackout in wide area because the possible way to take is only to cope with the accident by tentative insulators or by power system protection function at upstream Akangba Substation. Moreover, while the accident is recovered, power outage for a long period of time will continue at consumer side (Lagos Port, Tin Can Island Port, Industrial areas, ordinary homes, and naval facilities) and in the end, non-utility generation facilities will be used. As a result, port operation, industries and lives of ordinary homes will have a financial difficulty because of high cost of fuel used in non-utility generation facilities.

Next, the substation is difficult to operate and maintain because the substation lacks load switch and circuit breaker to sort circuits. And also, the substation needs to be renewed because the substation has continued to be operated for over 35 years and all substation facilities including main transformers has become decrepit. In Nigeria insufficient power supply is under a serious condition, and in the future substation facilities need to be enhanced accompanied by upgrade of power stations and transmission facilities. However, the substation cannot be upgraded largely and contribute to improvement of insufficient power supply because it does not play an ordinary part of substation (power system protection function and monitoring control function and maintainability). Accordingly, the urgency of the Project is high.

(3) Contribution to Port Facilities, Industry and Homes

1) Contribution to Port Facilities

Lagos State is the main port city in Nigeria, and port area in Apapa area is divided into Lagos Port and Tin Can Island Port. Lagos Port has the roads and railroads with an international level and port facilities to handle wheat, cement, refined oil, containers and frozen cargos, and it is the largest port facility in Nigeria as the terminal to be utilized by many customers. Lagos Port accounts for 40 % of total cargo import volumes in Nigeria, and is the hub port of trade in both Nigeria and all African region. And also, Tin Can Island Port is the second largest port behind Lagos Port, and accounts for 30 % of total cargo import volumes. At port facilities power has become an important infrastructure as power source of night lighting, monitoring system, refrigeration facilities and port operation system etc. However, power supply from distribution network has low reliability due to frequent blackouts, so non-utility power generation facilities are used as a backup power source during blackout period of time. Since fuel cost of non-utility generation facilities is high, problems in port operation have occur, and also in power supply from distribution network, electricity rates are said to be high considering frequent blackouts. The Project will contribute to improvement of port operation of Lagos Port and Tin Can Island Port thanks to the progress of reliability of power supply.

2) Contribution to Industry

In Apapa area, Ajinomoto Co., Inc. (condiment packing factory) and Sanyo Foods Co., Ltd. (instant noodles factory) as Japanese enterprises' factories. Also, there are many Japanese enterprises which utilize port facilities of Apapa area shown as Table 3-4-1. As Nigerian enterprises, Flour Mills of Nigeria Plc. (milling capacity more than 8,000 tons/day * one of the largest factories in the world), Dino (foods), Bua (sugar/cement) etc. and scores of oil/gas plants are densely concentrated. In also industry, most of the large, medium or small businesses use their non-utility generating facilities because their productive lines frequently halt and they suffer economic damages owing to power shortage and blackouts. In the case of non-utility generating facilities by diesel, manufacturing costs soar because of high fuel costs, and international competitiveness of industry becomes lower, and further it will lead to withdrawal of business and employment layoff, and in the end, industries in Nigeria will cause the collapse. The Project will contribute to Nigerian economic and industrial resurgence because stable and low-cost electricity can be supplied to the industries.

Table 3-4-1 Japanese Enterprises Which Utilize Port Facilities

Classification	The name of enterprise	Item
①At Apapa area	Ajinomoto	Seasonings (Packing) ※Owning its own factory
②Around Apapa area	YAMAHA	Motor bike (Assemble), Shipping equipment ※Owning its own factory
	CFAO (Invested by Toyota Tsusho)	Vehicles, Plastic, equipment, Medicines, Food, Beverage, BIC ball-point pen, Shavers ※Owing its own factory
③Utilizing of Apapa, Tincan Port (Owned by Nigerian Office)	Honda	Car (Assemble), Motor bike (Assemble), General-purpose machines ※Owning its own factory
	Sojitz	Vehicles, Iron and steel
	Taichi	Electrical appliances
	Nishizawa	Iron and steel, equipment, Daily necessities (stationeries, etc.)
	Marubeni	Iron and steel, equipment, Chemicals
	Mitsubishi	Iron and steel, Equipment
	Itocyu	Vehicles, Iron and steel
	Toyota Tsusho	Equipment, Chemicals
④Utilizing of Apapa, Tincan Port (Using Nigerian Agent without its own office)	Nissan	Car
	Toyota	Car
	Suzuki	Car, Shipping equipment
	Yokohama Tire	Tire
	Kaneka	Daily necessities (wig)
	Panasonic	Electrical appliances
	Daikin	Electrical appliances
	Makita	Implements
	Kawasho Foods	Canned foods (GEISHA)
	SONY	Electrical appliances

[Source] JICA

3) Contribution to homes

A lot of homes use small non-utility generating facilities by gas as backup while frequent power outages. However, high fuel costs of non-utility generating facilities pose much burden on low income homes. This is why the Project will contribute to improvement of household economy by reduction of fuel costs because of decrease in the number of power outages.

4) Operation and Maintenance Management Capabilities

With experience in daily operation and maintenance of its GIS and transformers, TCN is considered to have sufficient technical capabilities for such operation and maintenance management of the equipment and facilities to be procured and installed in the Project. This is why the present technology abilities of TCN will enable operation and maintenance of such facilities to be fully achieved, and there is no problem in the implementation of the Project.

Moreover, it is expected that the implementation of OJT by equipment suppliers will improve the further abilities of operation and maintenance in the Project.

5) The Project Which Contributes To Nigerian National Development Plan

In the Nigerian national development plan, "Nigeria Vision 20: 2020", infrastructure development (power/transport) has been declared as one of the top-priority issues. And also, in "Nigeria Economic Recovery & Growth Plan 2017-2020", the achievement of economic growth with global competitiveness has been declared as a strategic target, and fragile infrastructure has been pointed out as one of the hindrances to competitiveness of Nigerian economics, and also the necessity of investment of such infrastructures as power, roads, railroads, ports, internet (broadband) etc. has been emphasized. The Project will contribute to these development plans as power infrastructure development.

6) Influence to Environmental Society

As for the influence to environmental society given by substation facilities in the Project, slight noise from transformers and oil-leaking in the case of transformer accidents are enumerated. The level of noise from transformers is set less than the reference; under 55 dB (A) at boundary lines; in the Japanese Noise Control Law. Moreover, as to insulation oil leaking at accidents of transformers, the steps are taken by installing pressure-release reservoirs and oil retaining walls. In addition, substation facilities go along with surrounding environment better than the existing switch gear facilities because these substation facilities has adopted GIS type. Considering the above facts, the Project will never give a special influence in the aspect of environmental society.

7) Scheme of Japanese Grant Aid

It is possible that the Project will be executed without any specific difficulty because the Project has reasonable description of business and implementation schedule under the framework of the Japanese Grant Aid scheme with the fact that the country from which main equipment will be imported is Japan and that the Project will finish by the dead line of Exchange Note.

3-4-2 Effectiveness

Technical quantitative effects to be provided by the Project is as follows.

(1) Quantitative Effects

Table 3-4-2 Quantitative Effects

Indicator	Base Value (2017)	Target Value (2024) (3years from operation)
Electric energy at receiving end at Apapa Road Substation (GWh)	119	212
Times of power failure per customer (times/year)*[1]	132	80
Cumulative time of power failure per customer (time/year)*[1]	1,228	400

Note: *[1] Excluding the causes by upper systems than Akangba Substation (including power shortage of power stations)

(2) Qualitative Impacts Overall Project

Table 3-4-3 Qualitative Impacts Overall Project

Current state and issues	Steps to be taken (Cooperation project)	Level of effect and improvement
1. Non-utility generating facilities are used as a backup at port facilities at the time of power outages because the reliability of power supply from distribution networks is low and blackouts frequently occur. High fuel costs for non-utility generating facilities put port operation a burden. Moreover, unstable power supply causes decrease of productivity and efficiency in port businesses, and degradation of international competitiveness.	Blackouts will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits.	Operation of port facilities will be economically improved by the decrease in usage of non-utility generating facilities with high fuel costs at Lagos and Tin Can Island Port owing to decrease in the numbers of power outages. Moreover, productivity and efficiency of port will be improved owing to decrease in blackouts, so time of discharge of freights and custom clearance will be curtailed, and international competitiveness will be upgraded. As a result, cargo handling volumes will be increased and Nigerian economy will grow.
2. Non-utility generating facilities are used as a backup at port facilities at the time of power outages because power supply from distribution networks is unstable and power outages occur frequently. In case of non-utility generating facilities by diesel, high fuel costs raise manufacturing costs, degrade international competitiveness in the industries, and lead to withdrawal of businesses and dismissal of employment, and in the end, cause collapse of Nigerian industries. Moreover, power supply from distribution networks comes much short of power demand, so the growth of industries and Nigeria is hindered.	Blackouts will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits. Also, more power supply will be achieved by upgrading transformer capacities.	The stabilization of power supply in the Project will improve productivity and productive costs of industries, and international competitiveness, and in the end, it will contribute to resurgence of Nigerian economy and industry.
3. Many households use small non-utility generating facilities by gasoline as a backup owing to frequent blackouts. However, fuel costs of non-utility generating facilities are high, so low-income households owe large financial burden. Moreover, unstable power supply is one of the causes of no payment of electricity rates, and low billing collection rates will lead to operating money of power stations, and cause power supply shortage, which forms downward spiral.	Power outages will be decreased owing to high reliability by renewal of Apapa Road Substation and aging substation facilities, and expansion from one circuit to two circuits.	Remedy of power outages by the Project will contribute especially to the improvement of home economy of low-income households by the decrease in usage of non-utility generating facilities and fuel costs. Moreover, customer satisfaction will be improved and the collection rate of electricity bills will be upgraded.

[Appendices]

A-1 Member List of the Study Team

1. Member List of the Study Team

(1) First Field Survey (Survey on Outline Design)

Name	Assignment	Organization
Hiroto KAMIISHI	Team Leader	Japan International Corporation Agency
Taisuke MORIMOTO	Planning Management	Japan International Corporation Agency
Kyoji FUJII	Chief Consultant / Substation Planning	Yachiyo Engineering Co., Ltd.
Kazuo FUJITA	Substation Facilities	Yachiyo Engineering Co., Ltd.
Nobuyuki KINOSHITA	Substation Planning/Protection Control	Yachiyo Engineering Co., Ltd.
Masayuki TAMAI	Install Planning	Yachiyo Engineering Co., Ltd.
Satoshi SHISHIDO	Procurement Planning/Cost Estimation	Yachiyo Engineering Co., Ltd.
Teruo KURUMADA	Facilities Planning	Yachiyo Engineering Co., Ltd.
Koji ODA	Facilities Planning (2)	Yachiyo Engineering Co., Ltd.

(2) Second Field Survey

Name	Assignment	Organization
Kyoji FUJII	Chief Consultant / Substation Planning	Yachiyo Engineering Co., Ltd.
Kazuo FUJITA	Substation Facilities	Yachiyo Engineering Co., Ltd.
Masayuki TAMAI	Install Planning	Yachiyo Engineering Co., Ltd.
Satoshi SHISHIDO	Procurement Planning/Cost Estimation	Yachiyo Engineering Co., Ltd.

A-2 Study Schedule

2. Study Schedule

Preparatory Survey for the Project for
Emergency Rehabilitation of Lagos Transmission Substation
The Republic of Nigeria
The Itinerary of Second Field Survey (Submission of Draft Final Report)

(1) First field survey (July to August, 2017)

No.	Date	Day	Contents of Field Survey		Stay
			JICA Member	Consultant Member (CM)	
				Fujii/Fujita/Kinoshita/Tamai/Oda/Kurumada/Shishido	
1	Jul. 30	Sun.		Trip (Tokyo - London)	Flight
2	Jul. 31	Mon.		Trip (London - Abuja)	Abuja
3	Aug. 1	Tue.		- Courtesy call to JICA Nigeria Office, Embassy of Japan, FMPWH, TCN/Abuja * Explanation of the Inception Report and Grant Aid Scheme * Submission of questionnaires * Confirmation of other donors activities	Abuja
4	Aug. 2	Wed.		Trip (Abuja - Lagos)	Lagos
5	Aug. 3	Thu.		- Site survey (Akangba substation) - Power demand and system analysis	Lagos
6	Aug. 4	Fri.		- Site survey (Apapa substation) - Power demand and system analysis	Lagos
7	Aug. 5	Sat.		- Site survey (Apapa substation) - Power demand and system analysis	Lagos
8	Aug. 6	Sun.		- Preparation of Field Report	Lagos
9	Aug. 7	Mon.		- Preparation of Field Report	Lagos
10	Aug. 8	Tue.		- Site survey (Akangba substation) - Preparation of Field Report - Meeting with local surveyor	Lagos
11	Aug. 9	Wed.		- Site survey (Akangba substation) - Preparation of Field Report - Meeting with local surveyor	Lagos
12	Aug. 10	Thu.		- Site survey (Akangba substation) - Preparation of Field Report - Discussion work demarcation by Nigeria side - Meeting with local surveyor	Lagos
13	Aug. 11	Fri.		- Site survey (Akangba substation) - Preparation of Field Report - Discussion work demarcation by Nigeria side	Lagos
14	Aug. 12	Sat.		- Site survey (Akangba substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	Lagos
15	Aug. 13	Sun.	Trip (Tokyo – Abu Dhabi)	- Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Flight CM: Lagos

No.	Date	Day	Contents of Field Survey		Stay
			JICA Member	Consultant Member (CM)	
				Fujii/Fujita/Kinoshita/Tamai/Oda/Kurumada/Shishido	
16	Aug. 14	Mon.	Trip (Abu Dhabi - Lagos) - Site survey (Apapa substation) - Site survey (Akangba substation)	- Site survey (Apapa substation) - Site survey (Akangba substation)	Lagos
17	Aug. 15	Tue.	- Trip (Lagos - Abuja) - Courtesy call to JICA Nigeria Office, Embassy of Japan, FMPWH, TCN/Abuja - Discussion draft MD	- Site survey (Apapa substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Abuja CM: Lagos
18	Aug. 16	Wed.	- Discussion draft MD	- Site survey (Apapa substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Abuja CM: Lagos
19	Aug. 17	Thu.	- Discussion draft MD	- Site survey (Apapa substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Abuja CM: Lagos
20	Aug. 18	Fri.	- Signing of MD Trip (Abuja- Frankfurt)	- Site survey (Apapa substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Abuja CM: Lagos
21	Aug 19	Sat.	Trip (Frankfurt-Tokyo)	- Site survey (Apapa substation) - Preparation of Field Report - Preparation draft equipment specification - Data collection for cost estimation	JICA: Flight CM: Lagos
22	Aug. 20	Sun.	Trip (Frankfurt-Tokyo)	Trip (Lagos - Abuja) - Preparation of Field Report - Preparation draft equipment specification	JICA: Japan CM: Abuja
23	Aug. 21	Mon.		- Preparation of Field Report - Preparation draft equipment specification	Abuja
24	Aug. 22	Tue.		- Signing Field Report	Abuja
25	Aug. 23	Wed.		- Discussion TCN/Abuja	Abuja
26	Aug. 24	Thu.		- Discussion TCN/Abuja	Abuja
27	Aug. 25	Fri.		- Report to JICA Nigeria Office, Embassy of Japan, FMPWH、TCN/Abuja	Abuja
28	Aug. 26	Sat.		Preparation of report	Abuja
29	Aug. 27	Sun.		Trip (Abuja - London)	Flight
30	Aug. 28	Mon.		Trip (London – Tokyo)	

(2) First Additional survey (September, 2017)

No.	Date		Contents of survey		Stay
			JICA Member	Consultant Member (CM)	
				Fujii	
1	Sep. 19	Tue.		Trip (Paris-Lagos)	Lagos
2	Sep. 20	Wed.		Tax Survey	Lagos
3	Sep.21	Thu.		Tax Survey	Lagos
4	Sep. 22	Fri.		Tax Survey	Lagos
15	Sep. 23			Trip (Lagos - Freetown}	Freetown

(3) Second Additional survey (November, 2017)

No.	Date		Contents of survey		Stay
			JICA Member	Consultant Member (CM)	
				Fujii	
1	Nov. 18	Sat.		Trip (Dakar-Lome-Lagos)	Lagos
2	Sep. 19	Sun.		Tax Survey	Lagos
3	Sep.20	Mon.		Tax Survey Trip (Lagos-Paris)	Flight
4	Sep. 21	Tue.		Trip (Lagos-Paris) Trip (Paris- Tokyo)	Flight
15	Sep. 22	Wed.		Trip (Paris- Tokyo)	Tokyo

(4) Second Field Survey (December 2017)

No.	Date (Day)	Contents of Field Survey		Stay
		JICA Member	Consultant Member (CM)	
			Fujii/Fujita/Tamai/Shishido	
1	Dec.3(Sun.)		Trip (Tokyo - London) Trip (London - Abuja)	Abuja
2	Dec.4 (Mon.)		- Courtesy call to JICA Nigeria Office, FMPWH, TCN/Abuja *Submission and explanation of Draft Final Report and Draft Equipment Specification	Abuja
3	Dec.5 (Tue.)		- Courtesy call to FMBNP and FMFA - Explanation of Draft Final Report and Draft Equipment Specification to TCN	Abuja
4	Dec.6 (Wed.)		- Discussion of MD (Work by Nigeria side)	Abuja
5	Dec.7 (Thu.)		- Discussion of MD (Tax exemption)	Abuja
6	Dec.8 (Fri.)		- Signing of MD - Report to Embassy of Japan, Nigeria - Report to JICA Nigeria Office	Abuja
7	Dec.9 (Sat.)		Trip (Abuja - Lagos)	Lagos
8	Dec.10 (Sun.)		Data analysis	Lagos
9	Dec.11 (Mon.)		- Site survey (Apapa Road substation, Location of Mobile substation)	Lagos
10	Dec.12 (Tue.)		- Site survey (Akangba substation, Storage yard) -Site survey of candidate project	Abuja

No.	Date (Day)	Contents of Field Survey		Stay
		JICA Member	Consultant Member (CM)	
			Fujii/Fujita/Tamai/Shishido	
11	Dec.13 (Wed.)		-Site survey of candidate project Trip (Lagos - Abuja)	Abuka
12	Dec.14 (Thu.)		- Report to JICA Nigeria Office, FMPWH, TCN/Abuja	Abuja
13	Dec.15 (Fri.)		Trip (Abuja - London)	London
14	Dec.16 (Sat.)		Trip (London - Tokyo)	Flight
15	Dec.17 (Sun.)		Trip (- Tokyo)	Tokyo

A-3 List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient country

Name	Position
Federal Ministry of Budget and National Planning	
Mr. Lanre Adekanye	Deputy Director
Federal Ministry of Power, Works and Housing (FMPWH)	
Mr. Louis O. N. Edozien	Permanent Secretary (Power)
Engr. Katampe Sarah	Assistant director, Transmission Service Department
Engr. Philip Okpanafe	Chief Engineer, Power
Transmission Company of Nigeria (Corporate Headquarters)	
Mr. Usman Gur Muhammed	Interim MD/CEO
Engr. Adewumi G. Victor	Head, Transmission Service provider
Engr. Shehu Abba Aliyu	General Manager (System Planning & Development)
Mr. J. I. Dodo	Head (Legal)
Engr. Adekola Mathew Ajibade	Manager (JICA Project), System Planning & Development
Transmission Company of Nigeria (Akangba Substation)	
Engr. A. O. Dim	Assistant General Manager (Transmission)
Engr. Tony Dim	Manager
EKO Electricity Distribution PLC	
Engr. Ovie O. Adjekpiyede	H.O.G (Network Planning Group)
Engr. Ashok Saraf	Chief Tech. Off.
Nigeria Ports Authority	
Engr. Ovie O. Adjekpiyede	H.O.G (Network Planning Group)
Engr. Ashok Saraf	Chief Tech. Off.
Flour Mills of Nigeria Plc	
Engr. Festus Omotoyinbo	Head, Technical Division
Japan External Trade Organization (JETRO)	
Mr. Taku MIYAZAKI	Trade Commissioner Managing Director
Mr. Chiharu YAMAMURA	Deputy Trade Commissioner
Embassy of Japan in Nigeria	
Mr. Mitsuhiro INAMURA	Head of Development Cooperation, First Secretary
Mr. Hiroki OGAWA	First Secretary
JICA Nigeria Office	
Mr. Hirotaka NAKAMURA	Chief Representative
Ms. Makiko OKUMURA	Senior Representative
Mr. Takumi KOIDE	Project Formulation Advisor

A-4 Minutes of Discussions

(1) First field survey

(2) Second field survey

(1) First field survey

Minutes of Discussions
on the Preparatory Survey for the Project for
Emergency Rehabilitation of Lagos Transmission Substation

In response to the request from the Government of Federal Republic of Nigeria (hereinafter referred to as "Nigeria"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for Emergency Rehabilitation of Lagos Transmission Substation (hereinafter referred to as "the Project") to Nigeria, headed by Hiroto KAMIISHI, Director of Energy and Mining Group, Industrial Development and Public Policy Department, JICA, from 14th to 18th, August 2017. The Team held a series of discussions with the officials of the Government of Nigeria and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Abuja, 18th August, 2017

Hiroto Kamiishi
Leader
Preparatory Survey Team
Japan International Cooperation Agency

Japan

Afolabi John Oladele
Director
Transmission Services
The Federal Ministry of Power, Works and Housing
Nigeria

Usman Gur Mohammed
Interim Managing Director / CEO
Transmission Company of Nigeria
Nigeria

Witness

Eloho Samuel
Director
International Cooperation Department
Ministry of Budget and National Planning
Nigeria

ATTACHMENT

1. Objective of the Project

The objective of the Project is to achieve reliable and stable supply of the electricity by rehabilitation and reinforcement of the substation in Lagos, thereby contributing economic growth in Lagos.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Emergency Rehabilitation of Lagos Transmission Substation".

3. Project site

Both sides confirmed that the site of the Project is in Lagos, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The Transmission Company of Nigeria will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization chart is shown in Annex 2.

4-2. The line ministry of the Executing Agency is the Federal Ministry of Power, Works and Housing. The Federal Ministry of Power, Works and Housing shall be responsible for supervising the Executing Agency on behalf of the Government of Nigeria.

5. Items requested by the Government of Nigeria

5-1. As a result of discussions, both sides confirmed that the main items requested by the Government of Nigeria are as follows:

(A) Procurement and Installation

132kV GIS

33kV GIS

Control panels

Transformers

Ground transformers
Capacitor bank
Low voltage facilities
Substation grounding facility
(B) Procurement
Maintenance Tools for the Equipment to be installed
Spare parts for the Equipment to be installed
(C) Training
Basic training of operation and maintenance on installed equipment

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Nigeria side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.
As for the monitoring of the implementation of the Project, JICA requires Nigeria side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Nigeria side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.
The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Nigeria until 27th August.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Nigeria in order to explain its contents around early December 2017.

7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Nigeria side, JICA will finalize the Preparatory Survey Report and send it to Nigeria around February 2018.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Nigeria side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as "C" from the following considerations:
The project is likely to have minimal adverse impact on the environment under the JICA guidelines for environmental and social considerations (April 2010).

8-3. For the Project that will result in involuntary resettlement, the Nigeria side confirmed to prepare a Resettlement Action Plan (RAP)/Abbreviated Resettlement Action Plan (ARAP) and make it available to the public. In addition, the Nigeria side confirmed to provide the affected people with sufficient compensation and/or support in accordance with RAP/ARAP, which is consistent with JICA Guidelines for Environmental and Social Considerations (April, 2010), in a timely manner.

9. Other Relevant Issues

9.1 Status of the Survey

The Team explained that the purpose of the Survey is to collect necessary information for evaluating the relevance, appropriateness and urgency of the Project and for analyzing power system in Lagos, and also to identify the issues to be cleared for implementation of the Project. The Nigeria side has agreed to share all necessary information and data with the Team.

9.2 Counterpart Personnel

The Team requested for the Nigeria side that necessary number of counterpart personnel shall be assigned to the Team and necessary arrangements with related organizations be made during the Survey and implementation stage in Nigeria. The Nigeria side has agreed to it.

9.3 Office Space

The Team requested the Nigeria side that necessary arrangement of office space for the Team during the Survey in Nigeria. The Nigeria side agreed to arrange it.

9.4 Questionnaire

The Nigeria side shall answer to the Questionnaire submitted by the Team in English with relevant documents by 18th August.

9.5 Safety Consideration during the Project

The Team requested the Nigeria side to make the necessary arrangements to secure

the safety of persons concerned with the project at the project sites. The Nigeria side agreed to it.

9.6 Exemption of customs duties, internal taxes and other fiscal levies

Both sides confirmed that customs duties, internal taxes and other fiscal levies which may be imposed in Nigeria with respect to the purchase of the products and/or the services be exempted. Both sides also confirmed that the tax exemption procedure in Nigeria as Annex 6 as recognition at the present moment.

The contents of Annex 6 will be updated as the Preparatory Survey progresses, and eventually will be used in the implementation stage.

9.7 Tentative Schedule of the Project

The Team explained to the Nigeria side that the tentative schedule of the Project is as attached as Annex 7.

9.8 Components of the Project

Nigeria side requested that capacity of transformers installed in Apapa Road substation should cover the future demand in the area. The team explained the installation of capacitor bank may be less needed referring the fact that the power factor observed in Apapa Road substation has been within the appropriate range. The team explained an initial technical finding that the activation of the second circuit of Akangba – Apapa Road transmission line, by "T-off" connecting with the second Akangaba – Ojo transmission line, may improve the reliability of the power system. Both sides confirmed that components of the Project will be examined and discussed during the Preparatory Survey.

9.9 Securing mobile transformer(s)

The team, recognizing the importance of shortening the power outage time in the Apapa Road area, requested Nigeria side to install the mobile transformer(s) by Nigeria side during the construction period. Nigeria side confirmed they will secure the transformer(s) which is/are owned by TCN. Nigeria side also confirmed they will consult to Nigeria Railway Corporation (hereinafter referred to as "NRC") to secure the land owned by NRC to install the mobile transformer(s) during the implementation stage.

9.10 Budgetary measures of Nigeria side

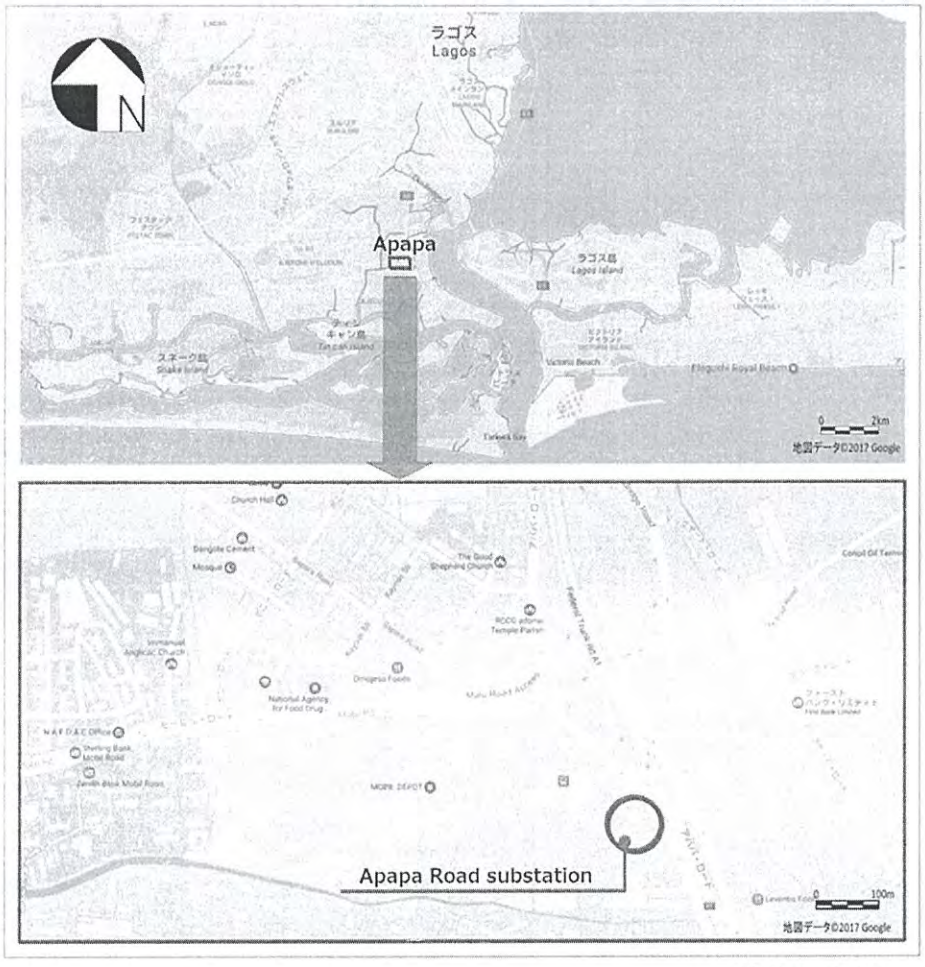
The team explained the estimated cost covered by Nigeria side will be notified in the 2nd Preparatory Survey which is scheduled around early December 2017. Nigeria side confirmed they will secure the necessary budget accordingly.

Annex 1 Project Site
Annex 2 Organization Chart of Transmission Company of Nigeria
Annex 3 Japanese Grant
Annex 4 Project Monitoring Report
Annex 5 Major Undertakings to be taken by the Government of Nigeria
Annex 6 Tax exemption procedures in Nigeria
Annex 7 Tentative Schedule of the Project

Annex 1 Project Site

■ Nigeria map

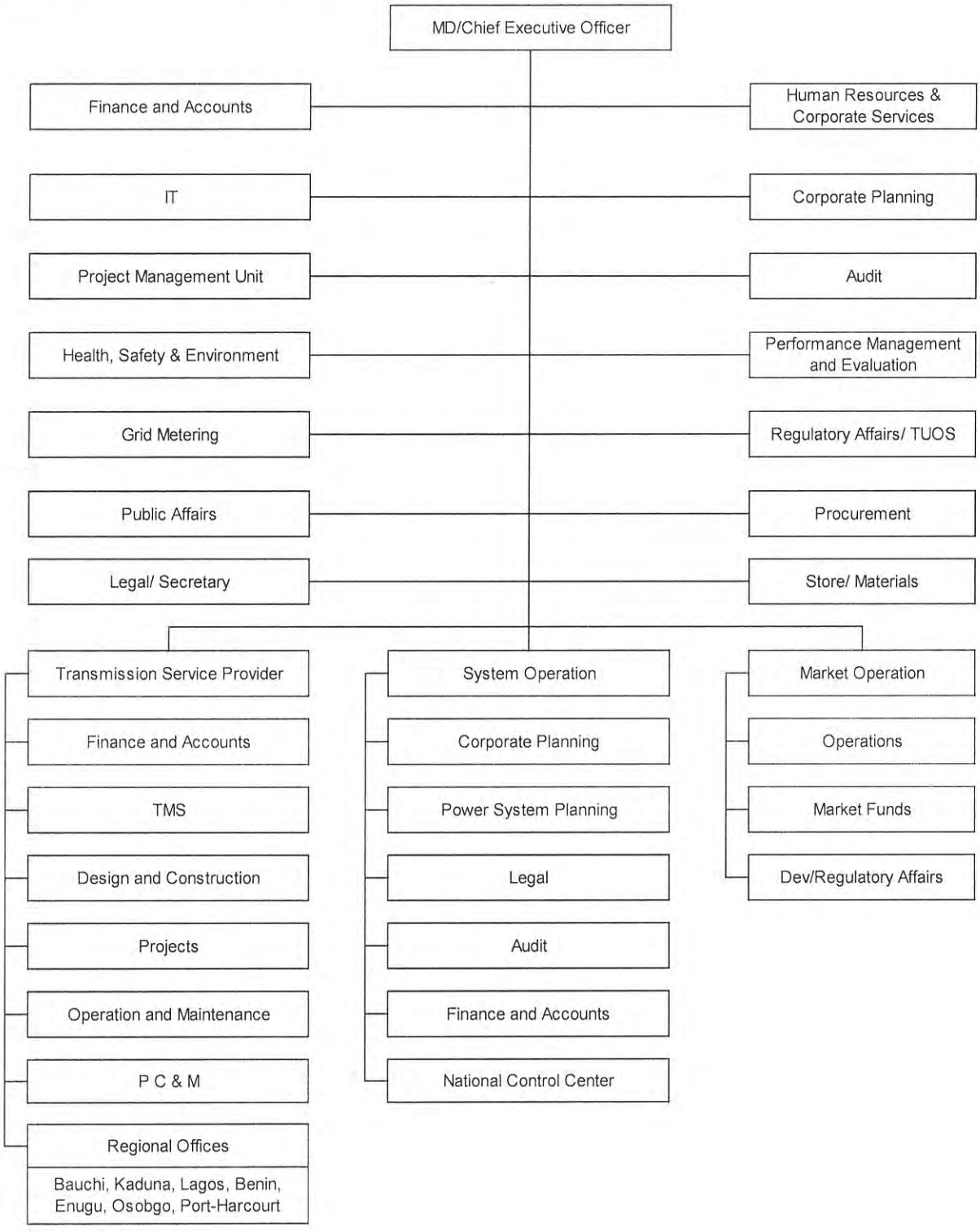
■ Africa map



■ Project site

Location map of project site

Annex 2 Organization Chart of Transmission Company of Nigeria



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will

be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by

using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

PROCEDURES OF JAPANESE GRANT

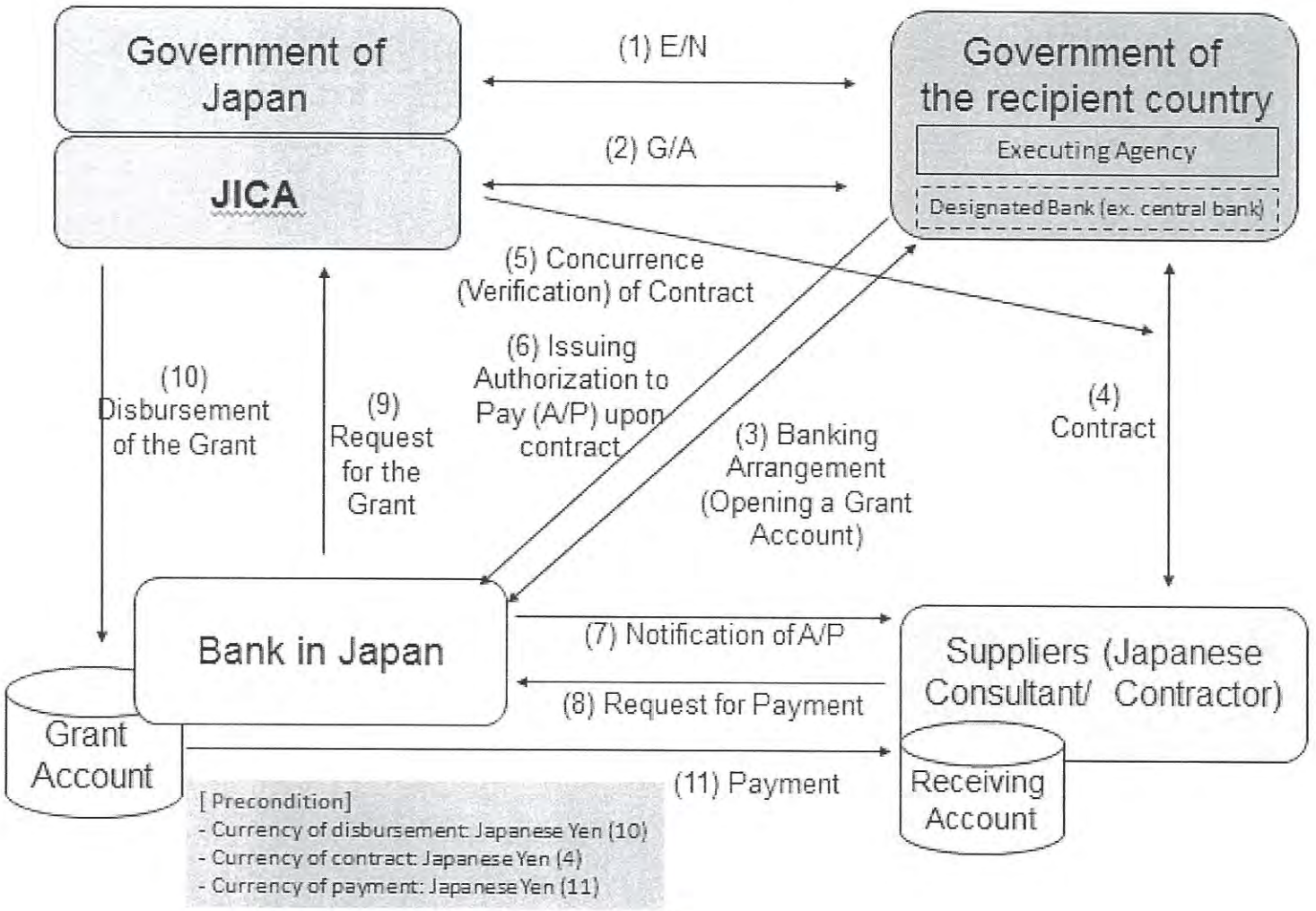
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual

	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*

Actual *(PMR)*

3-2 **Budgetary Arrangement**
- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*
Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low

	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/ Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Annex 5

Major Undertakings to be taken by the Government of Nigeria

1. Specific obligations of the Government of Nigeria which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost*	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	MBNP		
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	MBNP		
3	To secure necessary budget for the removal and demolition of existing equipment and facilities at Apapa Road substation	Before the signing of E/A	TCN		
4	To secure a mobile substation in working condition	before notice of the bidding document	TCN		
5	To secure and clear the following lands 1) project sites (Apapa Road Substation)	before notice of the bidding document	TCN		
6	To obtain the planning, zoning, building permit	before notice of the bidding document	TCN		
7	To clear, level and reclaim the following sites 1) leveling and reclaiming the sites (Apapa Road Substation)	before notice of the bidding document	TCN		
8	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding documents	TCN		

(B/A: Banking Arrangement, A/P: Authorization to pay, MBNP: Ministry of Budget and National Planning Finance)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost*	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	MBNP		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MBNP		
	2) Payment commission for A/P	every payment	MBNP		
3	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s) with internal transportation therein	during the Project	TCN		
4	To accord Japanese nationals and/or physical persons of third countries 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 country of the Recipient and stay therein for the performance of their work	during the Project	TCN		
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect	during the Project	FMF		

	to the purchase of the products and/or the services be exempted				
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	TCN		
7	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work	TCN		
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	TCN		
8	To submit a report concerning completion of the Project	within six months after completion of the Project	TCN		
9	To take necessary measure for safety construction - traffic control - rope off	during the construction	TCN		

(FMF:Federal Ministry of Finance)

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost*	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	TCN		

* The Estimated Cost will be discussed in the next survey scheduled in December 2017.

Annex 6
Tax exemption procedure in Nigeria

(1) Fiscal levies and taxes with respect to the corporate income（Corporate tax）

A. Tax Basic Information (name, percentage, how to calculate, basis law)

(1) Corporate Income Tax

1) Tax rate and calculation method

(a) There shall be levied and paid for each year of assessment in respect of total profits of every company, tax at the rate of thirty kobo for every naira in case of "Standard Profit".

- Definition of Standard Profit
  Standard Profit means - in the case of every company other than a Nigerian company and as respects any year of assessment commencing on 1st January 1989,
  (i) the amount of fifteen per cent of the turnover of the company for that year being turnover attributed to any part of the operations of the company carried out in Nigeria; or
  (ii) the amount of six million naira, whichever is greater.

(b) There shall, as from the assessment year commencing on 1st January, 1989 be levied and paid a special levy of fifteen per sent on excess profits of every company including banks and for the purpose of this section.

- Definition of Excess Profit
  "Excess profits" means the difference between total profits as computed in accordance with section 31of this Act and standard profits as calculated in accordance with the previsions of (a) (i) or (ii) of this section.

2) Basis law

Companies Income Tax Act CAP.60 LFN:1990

B Tax Exemption Procedure(procedure, application authority, required time)

To be filled out later (survey in progress)

C Other remarks

(2) Fiscal levies and taxes on their personal income（Personal income tax）

A. Tax Basic Information (name, percentage, how to calculate, basis law)

(1) Personal Income Tax

1) Tax rate and calculation method

0.5% of taxable income

2) Basis law

Personal Income Tax Act No.104,1993

B Tax Exemption Procedure(procedure, application authority, required time)

To be filled out later (survey in progress)

C Other remarks

(3) Indirect taxes such as Value added tax（VAT）

A. Tax Basic Information (name, percentage, how to calculate, basis law)

(1) Value Added Tax

1) Tax rate and calculation method

5% of taxable value

2) Basis law
Value Added Tax Act 1993 No.102,1993

B Tax Exemption Procedure(procedure, application authority, required time)
To be filled out later (survey in progress)

C Other remarks

(4) Duties and related fiscal charges with respect to the import and/or re-export of materials and equipment (Customs)

A. Tax Basic Information (name, percentage, how to calculate, basis law)
(1) Customs duties and excise duties imposed by Nigeria
1) Rate of tax
As shown in the attachment "CET_tariff"
2) Basis law
Customs and Excise Management Act,CAP84,1990

(2) Other duties and fiscal levies
1) Port Development Levy : 7% of the duties payable
2) ECOWAS Community Levy : 0.5%
3) Comprehensive Import Supervision Scheme Charge : 1% of the F.O.B value of imports
4) Statistical Tax : 1%

B Tax Exemption Procedure(procedure, application authority, required time)
To be filled out later (survey in progress)

C Other remarks

(5) Other taxes

A. Tax Basic Information (name, parentage, how to calculate)

B Tax Exemption Procedure(procedure, application authority, required time)

C Other remarks

Annex 7

Tentative Schedule of the Project

Year / Steps	2017					2018											2019			2020			2021		
	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	・・・	12	1	・・・	12	1	・・・	12
1st Preperatory Survey (Present Stage)	△																									
Examination (Developing outline design, Estimation, Undertakings etc.)																										
2nd Preperatory Survey (Explanation of Draft Preparatory Survey Report)					△																					
Cabinet meeting/approval							△																			
E/N, G/A									△																	
Construction supervision contract										△																
Detailed design																										
Tender/contract																										
Construction schedule (Procurement, Installation, Test and Inspection)																		2 or 3 years								

(2) Second field survey

Minutes of Discussions
on the Preparatory Survey for the Project
for Emergency Rehabilitation and Reinforcement of
Lagos Transmission Substations
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed between the Federal Ministry of Power, Works and Housing (hereinafter referred to as "FMPWH"), Transmission Company of Nigeria (hereinafter referred to as "TCN") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 18th August 2017 and in response to the request from the Government of Federal Republic of Nigeria (hereinafter referred to as "Nigeria") dated 3rd May 2017, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substations (hereinafter referred to as "the Project"), headed by Makiko Okumura, Senior Representative of JICA Nigeria Office from 4th to 8th December 2017.

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Abuja, 8th December 2017

Makiko Okumura
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Anthony Umuenyen
Deputy Director
Transmission Services
The Federal Ministry of Power, Works and Housing
Nigeria

Usman Gur Mohammed
Interim Managing Director / CEO
Transmission Company of Nigeria
Nigeria

Witness

Eloho Samuel
Director
International Cooperation Department
Ministry of Budget and National Planning
Nigeria

ATTACHEMENT

1. Objective of the Project

   The objective of the Project is to achieve reliable and stable supply of the electricity by rehabilitation and reinforcement of the substations in Lagos, thereby contributing sustainable economic and social development in Lagos.

2. Title of the Preparatory Survey

   Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substations".

3. Project site

   Both sides confirmed that the sites of the Project are in Lagos, which is shown in Annex 1.

4. Responsible authority for the Project

   Both sides confirmed the authorities responsible for the Project are as follows:

   4-1. TCN will be the executing agency for the Project (hereinafter referred to as "the Executing Agency"). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organization chart is shown in Annex 2.

   4-2. The line ministry of the Executing Agency is FMPWH. FMPWH shall be responsible for supervising the Executing Agency. FMPWH shall also be responsible for securing exemption of all taxes, customs duties and fiscal levies imposed in Nigeria related to the implementation of the Project.

   4-3. Ministry of Budget and National Planning is an agency responsible for managing the Japanese Grant Aid Projects.

5. Contents of the Draft Report

   After the explanation of the contents of the Draft Report by the Team, the Nigeria side agreed to its contents.

6. Cost estimates

   Both sides confirmed that the cost estimates including the contingency described in

the Draft Report is provisional and will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

7. Confidentiality of the cost estimates and technical specifications
Both sides confirmed that the cost estimates and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant
The Nigeria side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project. In addition, the Nigeria side agreed to take necessary measures according to the procedures.

9. Timeline for the project implementation
The Team explained to the Nigeria side that the expected timeline for the project implementation is as attached in Annex 4.

10. Expected outcomes and indicators
Both sides agreed that key indicators for expected outcomes are as follows. The Nigeria side will be responsible for the achievement of agreed key indicators targeted in year 2023 and shall monitor the progress based on those indicators.
[Quantitative indicators]

Indicator	Base Value (2017)	Target Value (2024) (3years after commissioning)
Electric energy at receiving end at Apapa Road Substation (GWh)	119	212
Times of power failure per one consumer (times /year)*1	132	80
Accumulated time of power failure per one consumer (time/year)*1	1,228	400

Note: *1 Excluding the causes by upper systems than Akangba Substation (including power shortage of power stations)

[Qualitative indicators]

Economic and social development is promoted in the surrounding area.

11. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. Both sides also confirmed that the Annex 5 will be used as an attachment of Grant Agreement (hereinafter referred to as "G/A").

11-1. Exemption of customes duties, internal taxes and other fiscal levies

Such customs duties, internal taxes and other fiscal levies including Value Added Tax (hereinafter referred to as "VAT"), commercial tax, income tax and corporate tax which may be imposed in Nigeria with respect to the purchase of the products and/or the services shall be exempted. FMPWH will take necessary action to ensure the exemption, through sending letters to Federal Ministry of Finance and other relevant authorities to have order(s) on the exemption and instruct all relevant agencies and offices to follow it. Such procedure can start just after the signing of Exchange of Notes (hereinafter referred to as "E/N") and G/A utilizing list(s) of equipment and its cost estimation, instead of actual invoice.

11-2. Budget to be secured by Nigeria side

The Nigeria side assured to take necessary measures and coordination including allocation of necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

11-3. Safety Consideration during the Project

The Team requested the Nigeria side to make necessary arrangements to secure safety of persons concerned with the Project. Both sides also confirmed the necessary arrangements and estimated cost regarding police officers to be hired by Nigeria side in accordance with the safety regulation of JICA. The Nigeria side agreed with it as Annex 9.

11-4. Securing a mobile transformer

Recognizing importance to shorten the power outage time in the Apapa Road area, the Team requested Nigeria side to install a mobile transformer by Nigeria side during the construction period. Nigeria side confirmed TCN will secure the transformer which is owned by TCN. Nigeria side also confirmed TCN will secure the land to install the mobile transformer during the implementation stage.

12. Monitoring during the implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (hereinafter referred to as "PMR") attached as Annex 6. The timing of submission of the PMR is described in Annex 5.

13. Project completion

Both sides confirmed that the project completes when all the facilities constructed and equipments procured by the grant are in operation. The completion of the Project will be reported to JICA promptly, but in any event not later than six months after completion of the Project.

14. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Nigeria side is required to provide necessary support for the data collection.

15. Schedule of the Study

JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Nigeria side around February 2018.

16. Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as C because the Project is likely to have minimal adverse impact on the environment under the Guidelines.

17. Other Relevant Issues

17-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

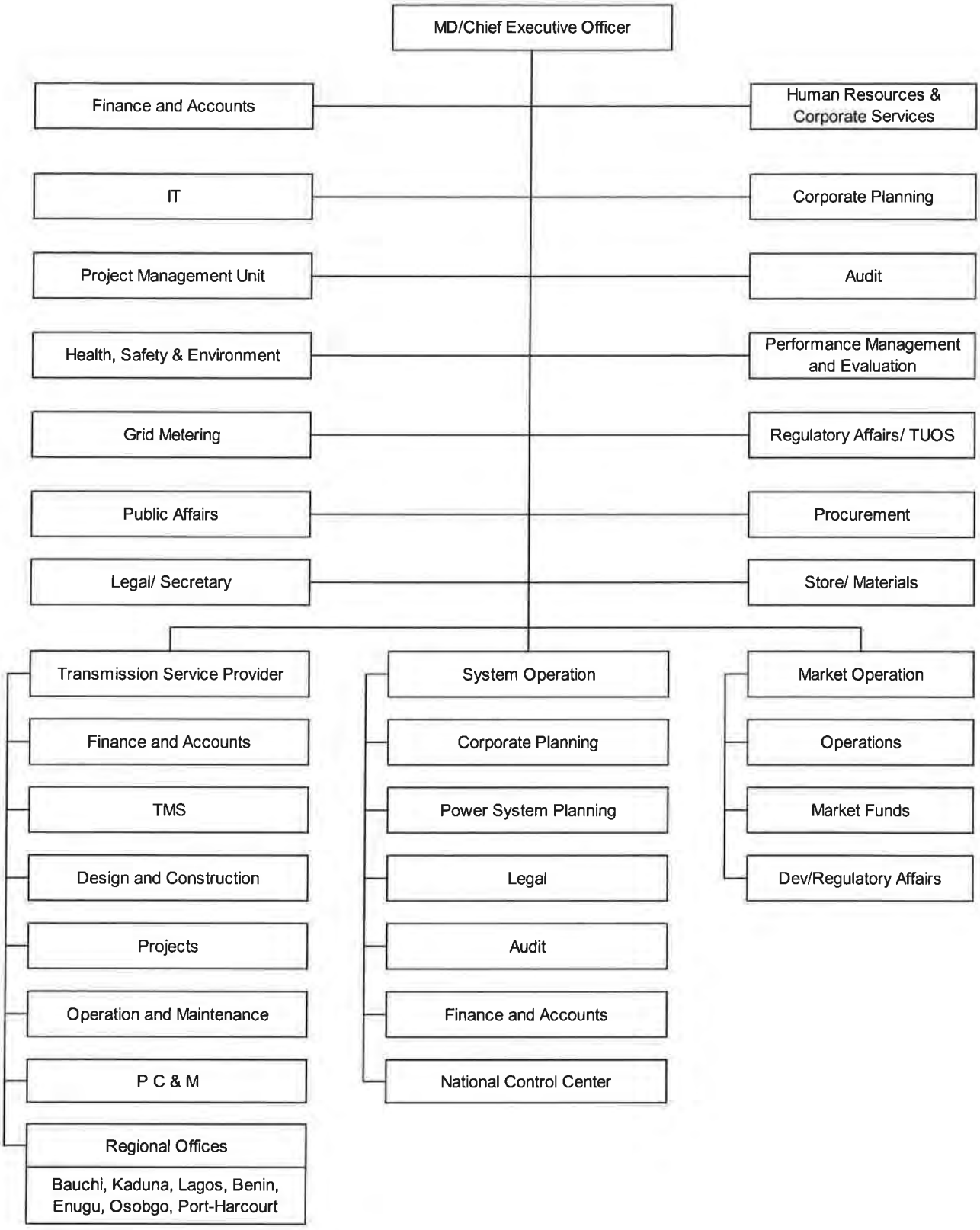
Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant
Annex 4 Project Implementation Schedule
Annex 5 Major Undertakings to be taken by the Government of Nigeria
Annex 6 Project Monitoring Report (template)
Annex 7 Budget to be secured by Nigeria side
Annex 8 Tax Exemption Procedure
Annex 9 Necessary Arrangements and Estimated Cost regarding Police Officers

Annex 1 Project Site

Africa map

Nigeria map

Annex 2 Organization Chart of Transmission Company of Nigeria



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will

be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by

using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

Annex 3

Attachment 1

PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

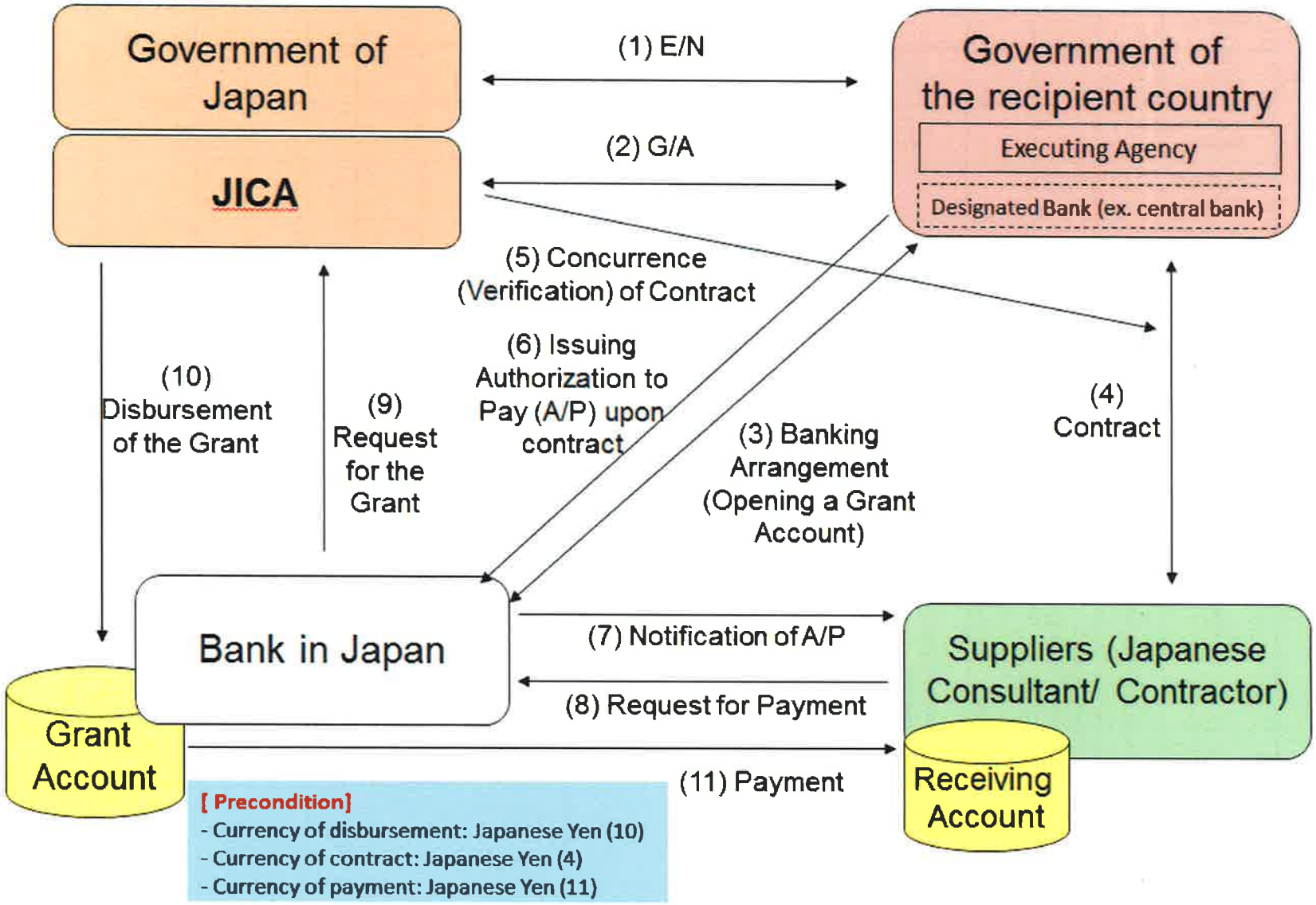
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Attachment 2

Financial Flow of Japanese Grant (A/P Type)



Annex 5 Major Undertakings to be taken by the Government of Nigeria

1. Specific obligations of the Government of Nigeria which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost (US$)
1	To open bank account (B/A)	within 1 month after the signing of the G/A	FMPWH	3,000
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	FMPWH	3,000
3	To secure land for a mobile substation, demolition of concrete wall next to ApapaRoad substation	before preparation of bidding document	TCN	51,000
4	To transport a mobile substation to the premises	before notice of the bidding document	TCN	9,000
5	To remove obstacles inside Apapa Road substation (containers, vehicles, foundations, kiosks, tree, etc.)	before notice of the bidding document	TCN	40,000
6	To obtain the planning, zoning, building permit of the Project	before notice of the bidding document	TCN	
7	To relocate existing 33kV and 11kV cables at Apapa Road substation (Power outage occurs)	before notice of the bidding document	TCN	20,000
8	To secure temporary storage yard in the railway territory next to Apapa Road substation	before notice of the bidding document	TCN	13,000
9	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding documents	TCN	
10	To secure guardsmen for a mobile substation	before notice of the bidding document	TCN	18,000
11	To secure armed police officer to protect Japanese supervisors	whenever Japanese supervisors are in Nigeria	TCN	2,000

(B/A: Banking Arrangement, A/P: Authorization to pay, MBNP: Ministry of Budget and National Planning Finance)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost (US$)
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	FMPWH	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A			24,000
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	FMPWH	
	2) Payment commission for A/P	every payment	FMPWH	
3	To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s)	during the Project	TCN	

	with internal transportation therein			
4	To accord Japanese nationals and/or physical persons of third countries 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 country of the Recipient and stay therein for the performance of their work	during the Project	TCN	
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted Federal Ministry of Finance shall issue an order regarding the exemption and instruct all agencies and offices to follow the order	during the Project	FMPWH	
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	TCN	
7	1) To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work	TCN	
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	TCN	
8	To submit a report concerning completion of the Project	within six months after completion of the Project	TCN	
9	Disconnection of 132kV lines (Akangba-Apapa Road and Ijora-Apapa Road) by screwing off the jumper wire (Power outage occurs)	during the Project	TCN	1,000
10	Connection switching and operation from existing substation to a mobile substation at Apapa Road substation (Power outage occurs)	during the Project	TCN	10,000
11	Removal of existing earthing transformers at Apapa Road substation	during the Project	TCN	16,000
12	Removal of existing emergency generator and enclosure at Apapa Road substation	during the Project	TCN	16,000
13	Demolition of concrete fire walls around 132/33kv transformers. Removal of a 132/33kv transformers, temporary 132kv switching equipment, switchgeras and control house at Apapa Road substation	during the Project	TCN	55,000
14	Changing-over from a mobile substation to new facilities of Apapa Road substation in coordination with EKEDC	during the Project	TCN	10,000
15	Transportation of a mobile substation and construction new wall at Apapa Road substation	during the Project	TCN	23,000
16	Procurement of 6 units of Watt-Hour meter for dealing with distribution companies at Apapa Road substation	during the Project	TCN	6,000
17	Procurement and installation of new 33kV cables and cable joints	during the Project	TCN	146,000

	for the connection of new facilities of Apapa Road substation and distribution substation (EKEDC)			
18	Bush clearing and site levelling at Akangba substation	during the Project	TCN	45,000
19	Changing-over "T" branch of 132kv lines (Akangba-Ojo 1) and connection of 132kv lines conductors at Akangba substation	during the Project	TCN	9,000
20	To secure guardsmen for a mobile substation	before notice of the bidding document	TCN	74,000
21	To secure armed police officer to protect Japanese supervisors	whenever Japanese supervisors are in Nigeria	TCN	87,000
22	To take necessary measure for safety construction - traffic control - rope off	during the construction	TCN	
23	Payment of Taxes (CISS and ETLS)	during the construction	FMPWH	205,000

(FMF:Federal Ministry of Finance)

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost (US$)
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	TCN	127,000 /year

2. Other obligations of the Government of Nigeria funded with the Grant

This page is closed due to the confidentiality

Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:
Executing Agency	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:
Line Ministry	Person in Charge (Designation) Contacts Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description	

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	**Assessment**
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
Actual Situation and Countermeasures	

(PMR)

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Annex 7

Budget to be secured by Nigeria side

(Tentative Schedule of Expenditure of Major Undertakings to be taken by Nigeria side)

(Unit:US$)

No.	Item	Total	2018	2019	2020	2021	2022	Term
1	**Apapa Road substation**							
1)	Secure land for a mobile substation, demolition of concrete wall	51,000	51,000					
2)	Transportation of a mobile substation	9,000	9,000					
3)	Removal of obstacles inside substation (containers, vehicles, foundations, kiosks, tree, etc.)	40,000	40,000					(1) Before the Tender
4)	Relocation of existing 33kv and 11kv cables, it includes outage	20,000	20,000					
5)	Secure temporary storage yard in the railway territory next to ApapaRoad substation	13,000	13,000					
6)	Disconnection of 132kv lines (Akangba-Apapa Road and Ijora-Apapa Road) by screwing off the jumper wire, it includes outage	1,000		500		500		
7)	Connection switching and operation from existing substation to a mobile substation, it includes outage	10,000		10,000				
8)	Removal of existing earthing transformers	16,000		16,000				
9)	Removal of existing emergency generator and enclosure	16,000		16,000				
10)	Demolition of concrete fire walls around 132/33kv transformers. Removal of a 132/33kv transformers, temporary 132kv switching equipment, switchgeras and control house	55,000		27,500	27,500			(2) During the Project Implementation
11)	Changing-over from a mobile substation to new substation	10,000				10,000		
12)	Transportation of a mobile substation and construction new wall	23,000				5,750	17,250	
13)	Procurement of 6 units of Watt-Hour meter for dealing with distribution companies	6,000				6,000		
14)	Procurement and installation of new 33kV cables and cable joints for the connection with distribution substation (EKEDC)	146,000				146,000		
15)	Employment of guardsmen for a mobile substation	92,000	17,800	23,700	23,700	23,700	3,100	(1) Before the Tender & (2) During the Project Implementation
16)	Armed mobile policemen for guard for Japanese supervisors	88,100	1,600	15,000	30,000	39,000	2,500	
2	**Akangba Substation**							
1)	Bush clearing and site levelling	45,000			45,000			(2) During the Project Implementation
2)	Changing-over "T" branch of 132kv lines (Akangba-Ojo 1) and connection of 132kv lines conductors	9,000			9,000			
3	**Payment of commission for Banking Arrangement (B/A) and Authorization to Pay (A/P)**	30,000	7,920	7,360	7,360	7,360		(1) Before the Tender & (2) During the Project Implementation
4	**Payment of Taxes (CISS and ETLS)**	205,000		46,000	112,000	47,000		
Total		885,100	160,320	162,060	254,560	285,310	22,850	

(Note)

Exchange rate: 1US$=Yen112.83

Annex 8 Tax Exemption Procedure

Sheet 1 Tax with respect to corporate income (Corporate Tax)

Items	Type of exemption	Applicable Law	rate(%)	How to calculate	Necessary Information
Companies income tax (CIT)	Be exempted	Companies Income Tax Act, Cap C21 LFN 2004 (CITA)	30%	For Nigerian companies, tax is levied on all taxable profits of the entity. However, for non-resident companies, tax is levied on the taxable profits attributable to its fixed base in Nigeria. In arriving at the taxable profit, the following should be noted: - The entity would be allowed to deduct from its revenue, recurring expenses which were incurred wholly, reasonably, exclusively and necessarily for the purpose of generating its Nigerian revenue. - The losses incurred in prior years as well as capital allowances claimable on the acquisition of capital expenditure may also be claimed.	**Organization in charge :** The Presidency ; The Federal Ministry of Finance ; The Federal Inland Revenue Service (FIRS) **Procedure :** The entity would be required to present a written application to the Presidency through the Federal Ministry of Finance. In the application, the entity would provide: - details of the project being undertaken in Nigeria; - specific justification for the exemption; and - any other relevant supporting document. After review of the application, the Presidency would make a decision and communicate same to applying entity **Duration :** One - six months
Tertiary Education Tax (TET)	Be exempted	Tertiary Education Trust Fund (Establishment, etc.) Act, 2011 (TETFA)	2%	Tertiary education tax is charged at 2% of the assessable profit of a company, as computed under the provisions of Companies Income Tax Act. Assessable profit is the adjustment of accounting profit (PBT) by non-taxable income and disallowable expenses but before adjusting capital allowances and brought forward losses. It should be noted that non-resident companies are ordinarily not liable to TET.	A CIT exemption could be extended to cover TET exemption. However, for purpose of clarity, it is advised that a TET exemption is also requested alongside a CIT exemption.

Sheet 2 Tax with respect to personal income (Personal Income Tax)

Items	Type of exemption	Applicable Law	rate(%)	How to calculate	Necessary Information
Personal Income tax	Be exempted	Personal Income Tax Act, Cap P10, LFN 2004, as amended (PITA)	The PIT rate is on a graduated scale. Details of the tax rates and related income tax bands are provided below: - First NGN 300,000 @ 7% - Next NGN 300,000 @ 11% - Next NGN 500,000 @ 15% - Next NGN 500,000 @ 19% - Next NGN 1,600,000 @ 21% - Above NGN 3,200,000 @ 24%	In arriving at the taxable income of an taxable individual, PITA grants Consolidated Relief Allowances (CRA) before arriving at the taxable income subjected to the applicable tax rates. The CRA is dependent on the annual income level of the tax payer. It is defined as the higher of N200,000 or 1% of gross income, plus 20% of gross income. This implies that employees with annual emolument of NGN 20million or less will have a CRA equal to NGN 200,000 plus 20% of gross income while those individuals with annual income above NGN 20,000,000 have CRA equal to 21% of their gross income. In addition to the CRA, the following social contributions are exempted from personal inome tax in arriving at the taxable income of individuals: - Pension contributions to a Nigerian pension scheme; - National Housing Fund contributions; - National Health Insurance Scheme contributions; - Premiums paid for life assurance; and - Interest paid on mortgage loan.	**Organization in charge :** The Federal Ministry of finance ; The relevant SBIR (States Board of Internal Revenue) at the states where the employees would be tax resident **Procedure :** The entity would be required to write to the Minister of Finance with details of the project being undertaken in Nigeria and specific justification for the exemption of the employees from personal income tax **Duration :** One to six months

(Sheet3) indirect tax etc (such as VAT, Commercial Tax)

Items	Type of exemption	Applicable Law	rate(%)	How to calculate	Necessary Information
Value Added Tax to be paid by entity on its purchases (Input VAT)	Be exempted or reimbursed in case exemption process is delayed	Value Added Tax Act, Cap V1, LFN 2004, as amended (VATA)	5%	VAT is chargeable on the supply of taxable goods and services or importation of all goods and services except those specifically listed in the First Schedule to the VATA i.e. the items listed as exempt or the items listed as zero rated.	**Organization in charge :** The Federal Ministry of Finance ; The Federal Inland Revenue Service **Procedure :** The entity could write to the Minister of Finance with details of the project being undertaken in Nigeria and specific justification for the exemption. Where the Minister is of the opinion that the circumstances are such as to render it expedient that such an exemption should be granted, the Minister may exempt the entity from paying VAT on purchases or imports. The Minister is required to ensure the notice for exemption is gazetted. **Duration :** One - Six months

(Sheet4) Duties etc.

Items	Type of exemption	Applicable Law	rate(%)	How to calculate	Necessary Information
Import Duty	Be exempted or reimbursed (in case exemption process is delayed)	- The 2015 - 2019 ECOWAS Common External Tariff ; - The Customs, Excise, Tariff, etc (Consolidation) Act No 4, 1995, as amended (CETA)	The rate to be applied is based on tariff classification of item being imported	Rate * CIF value of item being imported	Organization in charge : The Federal Ministry of Finance;The Nigeria Customs Service Procedure : There are 2 ways to obtain duty exemption (1) Under the Temporary importation (TI) regime or (2) Under the total duty exemption regime o Temporary importation: Under the TI regime, an enitity, directly or vide a 3PL could apply to the NCS (Nigeria Customs Service) to import goods into the country under the temporary import procedure. In this case, entity or the the 3PL would require the following documents whilst declaring the items for import (i.e. before begininning importation of the item): - A bank guarantee from a reputable bank - Hire agreement or evidence of ownership - Details of project where items would be deployed - Technical manuals describing the items to be imported - Covering Letter to NCS applying for TI approval - A copy of the entity's and or 3PL's tax clearance certificate (or exemption status) for the past 3 years Under the TI regime, items may remain in the country for a maximum of two years (i.e. an initial period of one year and two possible extensions for six months each), after which the guarantee would be released o Total exemption An entity engaged in power transmission could apply for duty exemption pursuant to the provisions of CETA (Customs, Excise, Tariff etc (Consolidation) Act) and the concessions provided under the 2016 FPM (Fiscal Policy Measures). The entity would be required to submit a formal application to the Minister of Finance vide the ministry relevant to the item being imported to benefit from the concessions. The following are the documents required for a duty waiver application: - Evidence of Registration with the Corporate Affairs Commission (Where applicable) - The Memorandum of Understanding duly signed by the Minister of Finance or Minister of state for Budget and National planning between the donor agency and the Federal Government of Nigeria - A proforma invoice indicating the value of imported items - Other supporting documents which may be requested by the Ministry of finance Where the Minister is of the opinion that the circumstances are such as to render it expedient that such an exemption should be granted, the Minister would exempt JCo (Japanese Comnapy) from import duties on items related to the project. Notwithstanding the foregoing, items imported from the ECOWAS region under the aegis of the ETLS shall be duly and quota free. The supplier would need to ensure it has oblain the relevant ETLS certificate (supporting the claim that the items have originated from the ECOWAS region) for the items being imported. Duration : Three - Twelve months
Port development levy (Surcharges)	Be exempted or reimbursed (in case exemption process is delayed)	General Nigerian import guidelines	7%	Rate * import duty	Organization in charge : The Nigeria Customs Service Procedure : Please refer to our comments around the temporary import regime in the procedure section of the import duty coloumn Under the TI regime, it is common practice for the Nigeria Customs Service to grant full exemption from surcharge payments. However, there are occasions where the Nigeria Customs Service excludes the surcharge (port charges) on the basis that the amount relates to a service charge for activities carried out on imported items and not actual taxes or levies. Either of these possibilities may be encountered in practice and may vary in application from one Nigeria Customs Service office to another. Meanwhile, please note that companies intending to claim this exemption are required to obtain a bank guarantee from a local bank and there would be ancillary bank charges for obtaining a bank guarantee from a local bank and these charges vary from bank to bank. Under the total exemption regime, the entity is required to submit a formal request to the responsible Ministry of the Project together with a proforma invoice indicating the value of imported items for the payment of CISS instead of the entity. Duration : One - three months

Comprehensive Import Supervision Scheme (CISS)	To be paid by responsible Ministry or implementing Agency directly	General Nigerian import guidelines	1%	Rate * FOB value of imported item	**Organization in charge :** The Nigeria Customs Service **Procedure :** Please refer to our comments around the temporary import regime in the procedure section of the import duty coloumn Under the TI regime, it is common practice for the Nigeria Customs Service to grant full exemption from CISS fees However, there are occasions where the Nigeria Customs Service excludes the CISS fees on the basis that the amount relates to a service charge for activities carried out on imported items and not actual taxes or levies Either of these possibilities may be encountered in practice and may vary in application from one Nigeria Customs Service office to another Meanwhile, please note that companies intending to claim this exemption are required to obtain a bank guarantee from a local bank and there would be ancillary bank charges for obtaining a bank guarantee from a local bank and these charges vary from bank to bank Under the total exemption regime, the entity is required to submit a formal request to the responsible Ministry of the Project together with a proforma invoice indicating the value of imported items for the payment of CISS instead of the entity **Duration :** One - three months
ECOWAS Trade Liberalisation Scheme (ETLS) levy	To be paid by responsible Ministry or implementing Agency directly	ECOWAS Regulations	0.5%	0.5% * CIF value of imported item	**Organization in charge :** The Nigeria Customs Service **Procedure :** Under the TI regime, it is common practice for the Nigeria Customs Service to grant full exemption from ETLS fees However, please note that companies intending to claim this exemption are required to obtain a bank guarantee from a local bank and there would be ancillary bank charges for obtaining a bank guarantee from a local bank and these charges vary from bank to bank Under the total exemption regime, the entity is required to submit a formal request to the responsible Ministry of the Project together with a proforma invoice indicating the value of imported items for the payment of ETLS instead of the entity **Duration :** N/A
VAT	Be exempted or reimbursed in case exemption process is delayed	Value Added Tax Act, Cap V1, LFN 2004, as amended (VATA)	5%	Rate * summation of the CIF value of costs of imported item, and all taxes, duties and levies paid/payable outside or by reason of importation into Nigeria	**Organization in charge :** The Federal Ministry of Finance ; The Federal Inland Revenue Service **Procedure :** The entity could write to the Minister of Finance with details of the project being undertaken in Nigeria and specific justification for the exemption Where the Minister is of the opinion that the circumstances are such as to render it expedient that such an exemption should be granted, the Minister may exempt the entity from paying VAT on imports The Minister is required to ensure the notice for exemption is gazetted **Duration :** One - Six months

(Sheet 5) Other taxes and levies

Items	Type of exemption	Applicable Law	rate(%)	How to calculate	Necessary Information
Withholding tax deducted from the entity's income	Be exempted	Companies Income Tax Act, Cap C21 LFN 2004 (CITA)	5%	WHT is deducted at the specified rate for payments to vendors or contractors	**Organization in charge :** The Presidency The Federal Ministry of Finance The Federal Inland Revenue Service **Procedure :** Companies Income tax exemption automatically exempts an entity from suffering WHT exemption. **Duration :** One to Six months
Withholding tax to be deducted by entity when paying its suppliers or vendors	Be exempted	Companies Income Tax Act, Cap C21 LFN 2004 (CITA) and the Personal Income Tax Act, Cap P10, LFN 2004, as amended (PITA)	5% or 10%	WHT is computed on the income earned by the supplier.	**Organization in charge :** The Federal Inland Revenue Service **Procedure :** There are no specific mechanisms for obtaining exemptions from deducting WHT upon payment to suppliers. However, an entity may write to FIRS (attaching supporting documents of its projects in Nigeria and importantly, an exemption letter from the Presidency from CIT liability) seeking exemptions from WHT obligations. **Duration :** One to Two months

Annex 9 Necessary Arrangements and Estimated Cost regarding Police Officers

1. Arrangement of Police officers

1) Arrangement of Police officers for Japanese supplier

TCN shall hire Police officers at his own expense for Japanese supplier during construction. Number of Police officers shall be two at minimum for the escort from one Japanese to four Japanese.

Driver (△)	1	2	2	2
Japanese supplier (○)	1	2	3	4
Police officers (●)	2	2	2	2
Number of car	1	2	2	2

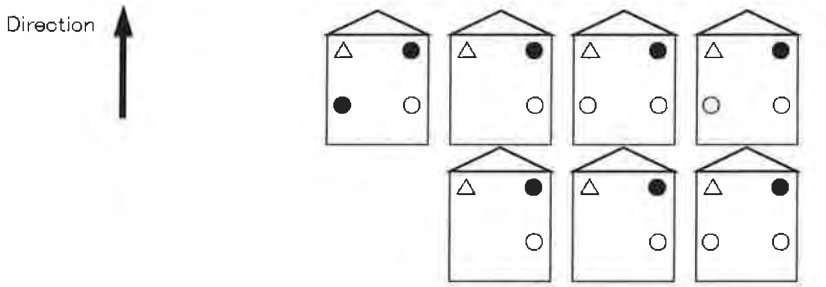


Figure 9-1 Arrangement of Police officers for Japanese supplier

2) Arrangement of Police officers for Japanese consultant
TCN shall hire Police officers at his own expense for Japanese consultant during construction. Number of Police officers shall be two at minimum for the escort from one Japanese to four Japanese.

Driver (△)	1	2	2	2
Japanese consultant (○)	1	2	3	4
Police officers (●)	2	2	2	2
Number of car	1	2	2	2

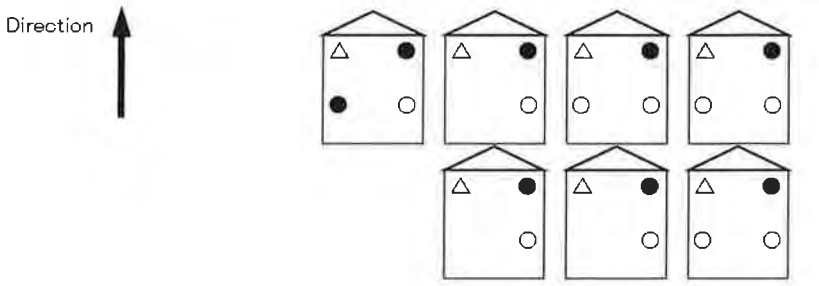


Figure 9-2 Arrangement of Police officers for Japanese consultant

2. Estimated cost regarding Police Officers

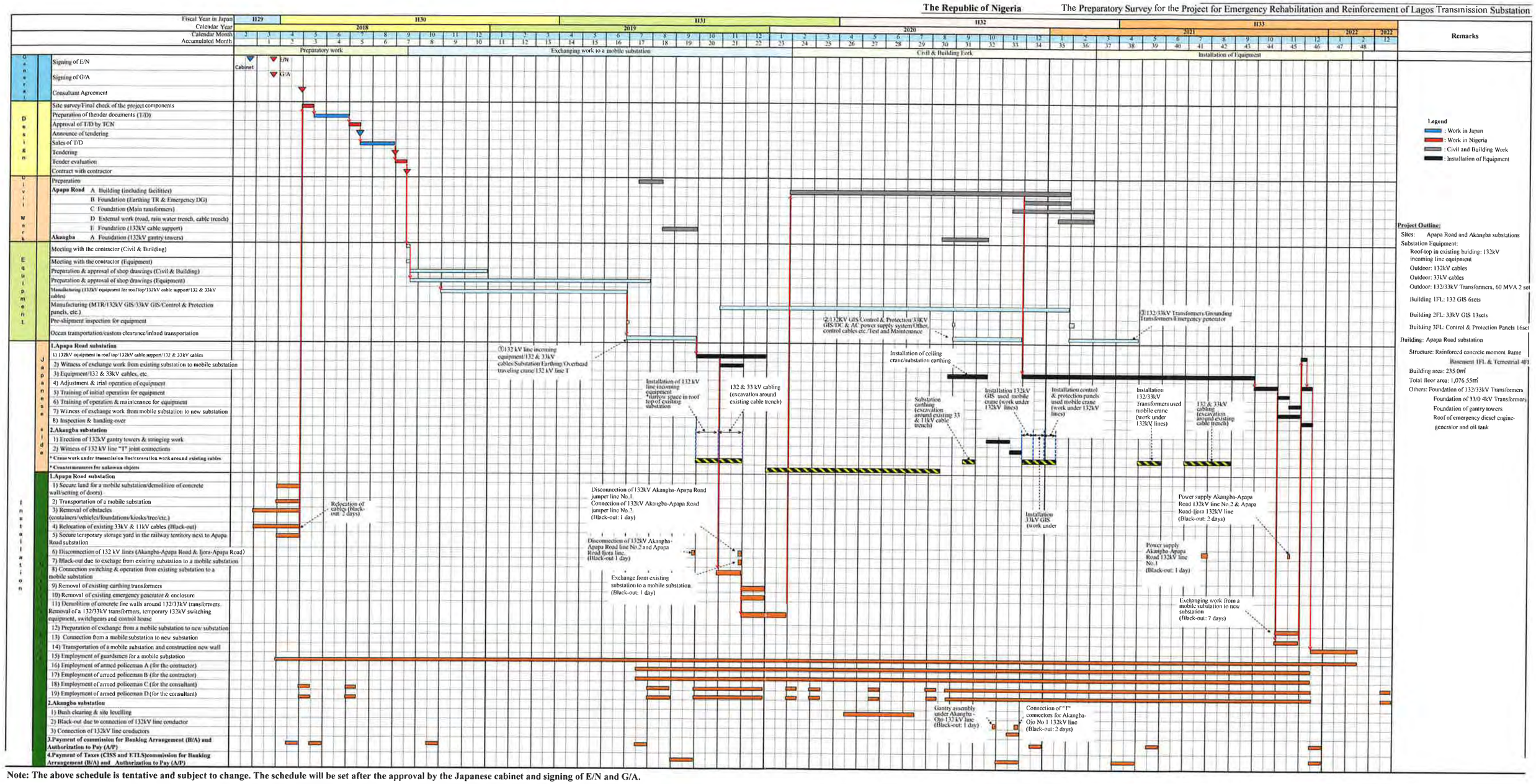
The estimated cost of Police Officers is NGN 26,860,000.

Table 9-1 Estimated cost regarding Police Officers

	Police Officer's Daily Alowance				Administrative Charge			
	Numbers of Police officers	Unit price of Daily allowance (NGN/ person)	Days	Subtotal of Daily allowance (NGN)	Unit price (NGN/ month)	Months	Subtotal (NGN)	Grand total (NGN)
Japanese supplier	2	5,000	900	9,000,000	200,000	31	6,200,000	
Japanese consultant	2	5,000	666	6,660,000	200,000	25	5,000,000	
Total				15,660,000			11,200,000	26,860,000

Annex 4 : Project Implementation Schedule

The Republic of Nigeria The Preparatory Survey for the Project for Emergency Rehabilitation and Reinforcement of Lagos Transmission Substation



Note: The above schedule is tentative and subject to change. The schedule will be set after the approval by the Japanese cabinet and signing of E/N and G/A.