LIST OF FIGURES AND TABLES

[Figures]

[Tables]

ABBREVIATIONS

BADEA	Banque Arabe pour le Developpement Economique en Afrique
DAC	Development Assistance Committee
DEG	Diesel Engine Generator
ECOWAS	Economic Community of West African States
EIA	Environmental Impact Assessment
EU	European Union
E/N	Exchange of Notes
GDP	Gross Domestic Product
GNI	Gross National Income
IDA	International Development Agency
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JCS	Japanese Cable Makers' Association Standard
JEAC	Japan Electric Association Code
JEC	Japanese Electrotechnical Committee
JEM	Standards of Japan Electrical Manufacturer's Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
LIWV	Lightning Impulse Withstand Voltage
MEP	Ministry of Energy and Power
NPA	National Power Authority
O&M	Operation and Maintenance
OJT	On the Job Training
PVC	Polyvinyl Chloride
PWP	Power and Water Project
RMU	Ring Main Unit
XLPE	Cross Linked Poly Ethylene

CHAPTER 1

BACKGROUND OF THE PROJECT

CHAPTER 1
BACKGROUND OF THE PROJECT

1-1 Background of the Study

Since 1991, Sierra Leone has been under an ongoing civil war, which was first initiated by the Revolutionary United Front (RUF) who opposes the government. Despite continued political instability due to a military coup in May 1997, a peace agreement between the Government of Sierra Leone and the RUF was signed thanks to the support of the Economic Community of West African States (ECOWAS), international organizations and the DDR project (disarmament, demobilization and reintegration), resulting in a return to relatively stable conditions. With an opportunity at hand, in January 2002 President Kabbah declared an end to the process of disarmament and the termination of civil war, thus paving the way for international and bilateral assistance for reconstruction and the resettlement of his people.

A project formulation study on the infrastructure (electric power, roads and water supply) was carried out by Japan by through the Japan International Cooperation Agency (JICA) between June and July 2005 with the aim of formulating a project pertaining to assistance for reconstruction in Sierra Leone. During the said study, it was confirmed that output from the generator (approximately 30 MW of the total rated output) at the Kingtom Power Station, which is the only power plant supplying electric power in Freetown City, the capital of Sierra Leone, had dropped due to deterioration in the main body of the generator and auxiliary facilities and available output had fallen to the 20 MW level. On the other hand, the maximum power demand of the city was estimated to be approximately 45 MW at the time in 2006. In addition to deteriorated power generating units, a distribution loss of approximately 40% or more was due to damaged or deteriorated power distribution systems, and so power supply capacity is extremely insufficient. As a result, rolling blackouts are a frequent occurrence and the household consumers are able to receive electricity for only a few hours, one day a week.

Faced with this situation, the Ministry of Energy and Power (MEP) and the National Power Authority (NPA) are installing diesel engine generators through the assistance of South Africa's national electricity supplier (ESKOM) and the *Banque Arabe pour le Développment Economique en Afrique* (BADEA: Arab Bank for Economic Development in Africa), and are constructing the Bumbuna hydropower plant through a syndicated loan mainly from Italian Commercial Bank partially guaranteed by the World Bank in order to secure necessary generation capacity. However, even after the construction of the new power source is completed, the available output of the Bumbuna hydropower plant will fall from 50 MW to 18 MW during the dry season (for 4 to 5 months); therefore it will be still difficult to secure the necessary capacity of stable electricity supply.

In view of the situation, in 2005 the Government of Sierra Leone deemed crucial the installation of a new power source to recover the capital function, and introduced a plan to develop a new power source of 100 MW over a ten-year period. The Government of Sierra Leone submitted a request to the Government of Japan for Grant Aid for the construction of a new diesel power generator with a total output of 10 MW as part of the output and the rehabilitation of the city's power distribution network in an effort to reduce distribution loss.

In response to this request, the Government of Japan carried out a preliminary study which was conducted by JICA in March 2006, confirming the relevance of constructing a 10 MW diesel engine generator, by collecting and analyzing data necessary to implementing a basic design study through (1) confirmation of the operation and maintenance conditions of the existing diesel engine generator and auxiliary facilities at the Kingtom Power Station, (2) investigation of deterioration and state of failure of the existing power distribution equipment in the distribution network in Freetown and a preliminary examination on the range of rehabilitation, (3) confirmation of the state of assistance for the electric power sector by the above-mentioned donors, and (4) confirmation of the existence of problems from an environmental and social point of view. With respect to the rehabilitation of the 33 kV and 11 kV distribution network (systems), it was also confirmed that the scope of assistance should be narrowed down in collaboration with improvements to the Freetown power distribution network through the Power and Water Project (PWP) being financed by the World Bank.

The requested components finally confirmed in the Basic Design Study are described as follows.

[Requested Components]

1. Construction of 2 sets of 5 MW DEG and associated ancillaries including an oil-water separator, incinerator, etc.
2. Construction of a Powerhouse to accommodate DEGs and necessary ancillaries.
3. Construction of the following 33/11 kV distribution systems.
   (1) A 33kV distribution line (D/L) from Wilberforce Primary Substation to Regent Primary Substation in Western Area including a 33kV feeder panel to be installed at Wilberforce Primary Substation.
   (2) Regent Primary Substation including a 33/11 kV, 5 MVA transformer and a substation house.
   (3) An 11kV D/L from Kingtom Power Station to Congo Cross Primary Substation including an 11kV feeder panel to be installed at Kingtom Power Station.
   (4) An 11kV D/L from Congo Cross Primary Substation to Wilberforce Primary Substation.
4. Procurement of the following 11 kV distribution Equipment and Materials with necessary accessories
   (1) From Falcon Bridge Primary Substation to Blackhall Road Primary Substation.

(2) From Regent Primary Substation to Guma water reservoir including compact substation(s) and 11 kV/400 V step-down transformer(s).

(3) Five (5) sets of five (5) way SF6 type 250 MVA switchboards (Ring Main Units) for Eastern Police, Africanus Road Riverside Drive, Spur Road and Lumley Village Substations.

5. Procurement of maintenance tools and spare parts for DEGs and 33/11 kV distribution systems.
6. Conducting of "On the Job Training (OJT)" for the operation and maintenance technique by the Equipment supplier(s) during installation period.

1-2 Natural Conditions

(1) Location, Geology and Topography, etc. of the Project Sites

The Kingtom Power Station, located in Freetown City, the capital of Sierra Leone, is built on flat land approximately 5 m above sea level and faces the Atlantic Ocean, approximately 25 km in a straight line from Lungi International Airport situated north of the city. The power station lot extends approximately 190 m from east to west and approximately 150 m from north to south and is surrounded by a concrete block fence. Residences for NPA staff are located outside. The powerhouse for the Project will be located near the center of the lot where power generating facilities once stood but later removed, and where only the concrete foundation remains today. In addition, there is a roofed corridor leading from the in-plant (premise) road on the south side of the lot to the existing powerhouse. The grounds of the lot are generally flat and comprised of reddish brown clay-like soil.

The proposed site for construction of the Regent Primary Substation is located approximately 8 km south-southeast from the Kingtom Power Station, approximately 400 m above sea level, and lies on partially sloping land on the south side of Regent road. Since the site is still in a natural state at the present time, it requires some preparation prior to construction of a new substation. Rock protrudes in some places on the lot grounds and along the edges, so bearing capacity for construction is expected to be adequate.

(2) Weather Conditions

1) Temperatures

As annual temperatures are relatively stable throughout the year, the change in monthly air temperature is extremely small and the maximum, minimum and mean temperatures do not fluctuate very much. The annual maximum temperature is 35.5 ℃ in May after which temperatures gradually begin to fall. The annual minimum temperature is 19.0 ℃ in December after which temperatures gradually begin to rise. The annual mean high temperature is 26.9 ℃.

2) Humidity

Similarly, as humidity also remains relatively steady throughout the year, the maximum monthly mean humidity is 89% for July, August and September; whereas the minimum is 69% for January, February and March. The annual mean humidity is 79.5%.

3) Rainfall

As the rainy season extends from May to October, the monthly mean rainfall during this season is very high at 479.4 mm. In addition, the maximum monthly mean rainfall during the rainy season is 805.6 mm in August; whereas, the minimum is 171.3 mm in May. As the dry season extends from November to April, the monthly mean rainfall during this season is extremely low at 37.2 mm. The minimum mean rainfall during the dry season is also extremely low at 9.5 mm per month. Annual mean rainfall is approximately 3,100 mm, making the average monthly rainfall approximately 258 mm. The difference in rainfall between the dry and rainy seasons is extremely large.

In addition, the total number of days with rainfall of 0.1 mm/day or more is 139 during the rainy season. Since the maximum number of days is 27 days a month, it rains almost every day during this period. On the other hand, the number of days of rain during the dry season is extremely small at 23 days in total. The average number of rainy days per month is only one.

4) Wind Velocity

As the monthly mean wind velocity remains almost constant, the maximum wind velocity is 13.5 km/h; whereas, the minimum is 9.9 km/h and the monthly mean wind velocity is 11.4 km/h. Major fluctuations in monthly wind velocity are uncommon. In addition, the monthly maximum mean frequency of heavy rain and storms is 4 times in May, June and October and the annual mean frequency is 24 times. The maximum mean wind velocity during this period is 76 km/h to 90 km/h.

5) Lightening

The maximum monthly number of days with lightening is 18 days during the wet season between May and October; whereas the minimum is 6 days. During this period, lightening occurs once every two (2) to five (5) days, so during the year there is no month in which lightening does not occur. As the average annual frequency of lightening is 104 times, lightening occurs once every three (3) to four (4) days. According to the available data, whether it is associated with rain or not cannot be distinguished.

6) Earthquakes

According to information obtained from the Meteorological Office, there is no record of earthquakes in Freetown.

7) Salt Contamination

Since the Kingtom Power Station and some distribution lines are located along the coast, the effects of salt contamination should be taken into account.

1-3 Environmental and Social Considerations

The National Environmental Action Plan was established in 1993 in Sierra Leone and the Environmental Protection Act was enacted in 2000 in accordance with the said plan. Under the said act a project implementing body is obligated to obtain a license for an environmental impact assessment (EIA) when implementing a project to construct power plants or power transmission lines. The project implementation body submits an application for an EIA license to the Environmental Protection Division of the Ministry of Lands, Housing, Country Planning and the Environment (MLHCPE) by attaching detailed project information. After considering the scale and location of a project, the presence of relocation of local residents and environmental impact, the director of the Environmental Protection Division responds on whether or not implementing an EIA is necessary within 14 days from the submission of the application. At this stage, if an EIA is judged to be unnecessary, an EIA license is issued. If an EIA is judged to be necessary, a project implementation body conducts an EIA and submits an environmental impact assessment to the Environmental Protection Division. The submitted EIA is disclosed to experts, related governmental agencies, NGOs and general public in order to obtain their comments.

Under the Project, the National Power Authority (NPA) will obtain necessary approval by the end of April 2007 in accordance with the Environmental Protection Act.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2
CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Objectives

In Sierra Leone Vision 2025, which is a long-term national development program officially announced in August 2003, 6 strategies were formulated in order to accomplish the program. Furthermore, since "maintenance and rehabilitation of electric power supply facilities and systems of the National Power Authority (NPA)" are stated as being one type of strategy implementation by the energy sector, promotion of socio-economic development by providing reliable and economic electric power to urban areas mainly in Freetown, the capital of Sierra Leone, is a high-priority policy.

In the policies, the Project is designed for the purpose of reinforcing and improving electric power supply facilities as an important social infrastructure indispensable to maintaining the capital function of Sierra Leone, stable operation of social and public facilities and improvement in living standards of residents living in Freetown and the surrounding area.

2-1-2 Outline of the Project

In order to accomplish the above-mentioned goal, by increasing the power generating capacity for base load operations in Freetown and the surrounding area, and improving power distribution systems in the city, the aim of the Project is to contribute to creating a stable power supply system in order to revitalize socio-economic activities in Freetown, the capital and to improve the living standards of the people.

The components of Japan's assistance will be an increase of two diesel engine generators (5 MW output each) at the existing Kingtom Power station which provides electric power in Freetown, to construct a 33/11 kV distribution substation for safe and efficient power distribution to consumers in the city, to construct 33 kV and 11 kV distribution lines, and to procure equipment and materials for 11 kV distribution lines.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Concept

The Project includes the procuring and installing of generating equipment for the base load operation (5 MW output×2 units) in Freetown, the construction of a 33/11 kV distribution substation and 33kV and 11 kV distribution lines, and the procuring of equipment and materials for 11 kV distribution lines.

The capacity and scale of equipment to be procured under the Project will be planned based on demand forecasting for the project sites. The capacity of the power generating system will be designed to meet power demand forecast after three (3) years from handing over the facilities. The equipment and materials for distribution systems will be designed to meet power demand forecast after ten (10) years from the commencement of the operation. The areas for the distribution network under the Project, which are not overlapped by an assistance program of other country or aid organization, are effective by a reduction in power losses in the distribution network in the city and are willing to pay power charges, will be selected for new distribution lines.

2-2-1-2 Natural Conditions

(1) Temperature and Humidity

Since the Project site is tropical oceanic climate, temperatures remain high at 26 °C to 28 °C throughout the year and humidity is also high at 74 % to 84 %. The diesel engine and generators to be procured under the Project will be installed inside the building, so special attention should not be given to ensuring the ambient temperature. However, when considering engine exhaust and ventilation in the engine room, 40 °C for design temperature, 35 °C for the electric room and 40 °C for outdoor equipment should be taken into account in order to ensure equipment function.

In addition, of the substation facilities to be adopted under the Project, since some 33 kV and 11 kV equipment will be installed outside, structural considerations should be given for the indoor-type enclosed feeder panel by taking appropriate measures for rises in temperature due to the ambient temperature or direct sunlight so as not to hinder operation and maintenance. In particular, the adoption of a space heater for humidity in closed panels will be considered in order to prevent dew condensation from occurring due to temperature fluctuations. Moreover, the impact of salt damage on equipment and materials to be constructed in the lot along the coast will also be taken into consideration.

(2) Earthquakes

Sierra Leone has no record of earthquakes, so no special considerations are necessary. However, a 0.1G lateral seismic factor generally adopted in Japan will be applied to the equipment in order to prevent any damage from occurring during shipping.

2-2-1-3 Socio-economic Conditions

Although nearly sixty (60) % of residents in Sierra Leone are Muslim, many of Freetown's residents are Christian. Therefore, a lower impact on the construction period is expected, even during Ramadan. However, in the case of starting construction work for the power station and rehabilitation work for distribution lines, project information should be announced to local residents in advance, and better awareness of the implementation of the Project should be promoted.

2-2-1-4 Procurement Conditions

Although the existing No. 6 Diesel Engine Generator (DEG) was installed at the Kingtom Power Station through a previous Japanese assistance and the DEG of ESKOM (South Africa's national electricity supplier) has been installed in recent years, local construction companies do not have enough experience in installing large generating facilities or substations, so they work as subcontractors for overseas construction companies. However, workers, vehicles for transporting materials aside from heavy cargo, and small-scale construction machinery, are locally available.

As the generating equipment to be procured under the Project will be installed next to the existing generating equipment in operation, safety measures such as protective sheets should be taken into account in order to protect the existing facilities from damages during the construction work and to ensure safety for those who involved in construction work.

2-2-1-5 Effective Use of Local Construction Companies, Local Equipment and materials

(1) Effective Use of Local Companies

In the case of constructing the facilities and installing the generating facilities and substation facilities under the Project, local construction companies will be effectively utilized mainly for construction machinery and labor. Engineers should be dispatched from Japan for quality control, schedule control, safety control, testing and adjustment.

Fifteen ton-class cranes are available and will be utilized effectively for transporting construction machinery and materials. In addition, although containers and up to 20 tons of cargo can be

transported by vehicles owned by local transporters, local companies do not have transport equipment for heavy cargo such as engines or generators, so hydraulic low-slung trailers, etc. should be procured from a third country.

(2) Effective Use of Local Equipment and materials

Although raw materials for foundation work such as aggregates, cement and reinforcing bars are available in Sierra Leone, equipment and materials for mechanical and electrical work such as building steel frames, finishing and equipment materials, piping materials and cables for the generating facilities should be procured from Japan or a third country.

(3) Procurement of Products Produced in Third Countries

In the case of procuring equipment from a third country, price, quality, delivery date, ease of procuring spare parts after starting operation, after-service system, and compatibility with the existing equipment should be sufficiently examined.

All power generating and distribution equipment and materials in Sierra Leone are imported products and many European products have also been introduced. Accordingly, the procurement of raw equipment and materials necessary for improving circuit breaker panels for the generating facilities and power distribution systems from a third country should be sufficiently examined. However, with respect to the power generation facilities, Sierra Leone has strongly requested the adoption of Japanese products due to the results of operation of the existing generating facilities procured under the previous Japan's grant aid project, quality and durability, the quality of after-service from manufacturers, and the ease of acquiring operation and maintenance skills related to Japanese-produced generating facilities. Considering that the power generating facility at the Kingtom Power Station procured under the previous Japan's grant aid project is the almost only facility that has been operated in a stable manner for a long period of time, the request of the Sierra Leonean side is judged to be appropriate.

2-2-1-6 Maintenance and Management Capability of Implementing Agency

In a similar manner as existing facilities, the National Power Authority (NPA) will maintain the relevant generating facilities after service begins. Since NPA has operated generating equipment similar to the equipment to be procured under the project from previous assistance and the existing equipment has now been in operation for more than ten (10) years, they have the maintenance capability. However, operation was suspended for an extended period of time (approximately 7 months) due to a shaft bearing breakdown, so their knowledge of preventive maintenance including daily inspections appears to be insufficient. Japanese engineers will provide on-the-job training (OJT) which will include the importance of daily and periodical inspections, necessary spare parts, testing

instruments, maintenance tools, operation and maintenance manuals. In addition, an operation and maintenance system after the start of services will be suggested for more effective and efficient operation of the facilities to be contracted.

2-2-1-7 Scope of Facilities and Equipment, Grade Setting

In due consideration of the above-mentioned conditions, the following basic principles related to the scope of procurement and installation of equipment and materials and the technical level in the Project will be formulated.

(1) Principles on Scope of Facilities and Equipment, etc.

The capacity of the generating facilities to be procured under the Project will be designed in order to supplement base load operation in Freetown for power demand in 2012 (3 years after the start of operation). The configuration of the facilities should be efficient and economical.

In addition, power distribution equipment and materials should be adopted based on the standards of NPA to simplify operation and maintenance.

(2) Principles on Grade Setting

Specifications of power generation and distribution equipment to be procured under the Project should not deviate from the technical level of NPA that will implement operation and maintenance after the start of services.

2-2-1-8 Construction and Procurement Methods, Work Period

Since the Project will be carried out in accordance with the Japanese Grant Aid scheme, the installation work of distribution system (Phase-1) should be completed within a single year and the installation of generating facilities (Phase-2) should be completed within two fiscal years. Moreover, in order to complete the Project within the prescribed construction period and to produce the expected effects, process planning should be formulated by coordinating work to be taken by the Japanese side and the Sierra Leonean side, inland transportation routes and methods, the term of construction and various other procedures, etc.

2-2-2 Basic Plan

2-2-2-1 Master Plan

(1) Design Conditions

As a result of examining the above-mentioned various conditions in the case of formulating the scale and specifications of the Project, the following design conditions will be established.

1) Construction Site, Location and Altitude

① Generation facility construction site: In the lot at the existing Kingtom Power Station

② Substation construction site: Regent village in Mountainous Rural District, approximately 406 m above sea level

2) Weather and natural Conditions

① Ambient temperature:

Maximum/maximum mean temperature: 35.3 ℃ / 31.4 ℃ (annual)

Annual mean: 26.9 ℃

Minimum/minimum mean temperature: 19.0 ℃ / 22.5 ℃ (annual)

② Design temperature:

indoor equipment: 40 ℃ (maximum), at an ambient temperature of 36 ℃

Outdoor equipment: 40 ℃ (maximum)

③ Design relative humidity: 90% in maximum

④ Design wind speed: 25 m/second

⑤ Rainfall: Annual maximum mean 3,100 mm

⑥ Iso-keraunic level (IKL): 104 days
(Annual number of days with thunders and rain)

⑦ Salt deposit density: 0.5 mg/cm^2

⑧ Seismic force: 0.1 G horizontal direction
(only applied to electric appliances)

⑨ Bearing capacity: Assumed to be 10 ton/m^2

3) Applicable Standards

① Japanese Industrial Standards (JIS) : Applied to industrial products in general

② Japanese Electrotechnical Committee (JEC) : Applied to electrical products in general

③ Japan Electrical Manufacturers' Association (JEM) : As above

④ Japanese Electric wire and Cable Makers' Association (JCS) : Applied to electric wires and cables

⑤ Technical standards for electrical installations: Applied to electrical work in general
⑥ International Electrotechnical Commission (IEC) : Applied to electrical products in general
⑦ International Organization for Standardization (ISO) : Applied to electrical and mechanical products in general
⑧ Sierra Leone-related standards and code : Mainly applied to related construction work

4) Units

International system of units (SI units) will be applied in principle.

5) Electrical System

Electrical system shown in Table 2-2-2-1-(1) will be applied under the Project in order to conform to the existing facilities.

Table 2-2-2-1-(1) Electrical System

Item	Distribution Line		Low Voltage (AC)	Low Voltage (DC)
Nominal Voltage	33 kV	11 kV	415 - 240 V	110 V
Maximum Voltage	36 kV	12 kV	460 - 252 V	121 V
Wiring Method	3-phase 3-wires		3-phase 4-wires	2-wires
Frequency	50Hz			-
Earthing Method	Transformer earthing (Non-effectively earthing system))		Neutral direct earthing (Effective)	(－) side grounding

6) Basic Impulse Withstand Voltage

In the case of designing power transmission facilities and substations, the following basic impulse withstand voltage (LIWV) which are applied to the existing facilities will be used as standards in order to ensure insulation coordination between equipment and dielectric (insulating) strength of the overall system.

① 33 kV system : LIWV 170 kV
② 11 kV system : LIWV 95 kV

7) Environmental Protection Standards

In the case of constructing new power generating facilities, related codes and standards for the environmental protection have not yet been established in Sierra Leone. Consequently, the following reference values will be regarded to be design conditions in due consideration of Japanese standards and local situations.

①	NOx emission standard	:	Not more than 950 ppm (at the time of 13% of residual oxygen density)
②	SOx emission standard	:	Not more than 250 ppm (at the time of 1% of sulfur content in fuel oil)
③	Oil content emission standard	:	Not more than 50 ppm
④	Dust emission standard	:	Not more than 100 mg/Nm^3
⑤	Noise level	:	Not more than 110 dB (A) at the time of operating only the relevant generating equipment (1m from the facility)
⑥	Vibration level	:	Not more than 65 dB in the property boundary at the time of operating only relevant equipment

(2) Facility Layout Plan

A layout plan for power generation and distribution facilities to be installed under the Project is described as follows.

1) Power Generation Equipment

By constructing a new powerhouse next to the existing No. 6 DEG at the Kingtom Power Station, the power generation equipment to be procured under the Project (such as engine generators and auxiliary equipment and low voltage power panels) will be installed in the powerhouse (Refer to Basic Design Drawing G-G01).

For easy operation and maintenance, diesel engine generators (DEGs) and auxiliary equipment will be installed in the DEG room in the new powerhouse to be constructed; whereas, circuit breaker panels, generator control panels and low voltage power panels will be installed in the electric room. An air intake blower will be installed in the blower room and a sludge treatment system will be installed in an underground pit; whereas, radiators and tanks will be installed outside.

As fuel for the diesel engine (heavy oil, diesel oil) is scheduled to be supplied from existing heavy oil and diesel oil tanks, fuel oil storage tanks will not be constructed.

The flowability of heavy oil is poor due to high kinetic viscosity of 175 cst. Accordingly, heating and thermal insulation will be taken using an electrical heating system for tanks or the piping systems in order to ensure the flowability of heavy oil. Although heating and thermal insulation for the existing No. 6 DEG under the previous assistance was done using steam, an electrical heating system will be applied under the Project from the viewpoint of reliability in operation of DEGs and ease of maintenance.

Some 11 kV circuit breakers for the generating system will be installed in the existing 11 kV circuit breaker room next to the existing panels. Control (monitoring) panels will be installed in the existing control room.

2) Power Distribution System

As shown in Figure D-G11, the building for the Regent Primary Substation to be constructed under the Project will be comprised of a distribution room, a low voltage panel room, an office and toilets. In a similar manner as the existing substation, both 33 kV, 11 kV and low voltage feeder panels will be indoor types; whereas, 33 kV and 11 kV transformers and a station transformer will be outdoor type. Both transformers have on-load tap changer in order to ensure electric power quality. In principle, each equipment will be operated at the site.

The type of distribution line, namely, underground cables and overhead distribution wiring will be applied to 33 kV and 11 kV distribution systems considering the ease of installation and maintenance. If there are routes with the existing distribution lines, they should be constructed along the same routes wherever possible.

On the other hand, since there is no space to install new electric poles along some new 11 kV distribution routes and therefore necessary to replace existing low voltage electric poles, a method through which high voltage and low voltage can be jointly utilizing will be adopted.

2-2-2-2 Basic Plan Overview

A basic plan based on the above-mentioned design principles (Refer to 2-2-1-1) and design standards and facility layout plan are outlined in Table 2-2-2-2-(1).

Table 2-2-2-2-(1) Outline of the Basic Plan

	Description
Freetown Power Distribution Network Improvement Plan (Phase-1)	**1. Procurement & Installation of Following Equipment:** (1) Construction of 33 kV Regent primary substation with the following equipment 33 kV, 11 kV indoor-type feeder panel & low-voltage feeder panel A power distribution transformer (33/11 kV, 5 MVA), a station transformer (11 kV/415 to 240 V, 630 kVA) Other necessary auxiliary equipment & foundations (2) Extension of 33 kV distribution lines from Wilberforce Primary Substation to Regent Primary Substation 1) Approx.3.2km of underground cable and approx. 1.3km of overhead line. 2) A 33 kV power feeder panel in Wilberforce Primary Substation. (3) Construction of 11 kV power distribution lines 1) Between Kingtom Power Station and Congo Cross Primary Substation: Approx. 3.3 km of overhead line & approx. 0.5 km of underground cable, 2) A 11 kV feeder panel each for Kingtom Power Station and Congo Cross Primary Substation 3) Between Congo Cross Primary Substation and Wilberforce Primary Substation: Approx 2.5 km of overhead line **2. Procurement of Following Equipment and materials (Installation work shall be done by Sierra Leone)** (1) Materials for 11kV power distribution line between Falcon Bridge Primary Substation and Blackhall Road Primary Substation: Approx. 0.8 km of overhead line and approx.2.6 km of underground cable (2) Materials for 11kV power distribution line between Regent Primary Substation and following distribution substations: 1) To Guma Water Reservoir: Approx. 1.3 km of 11kV overhead line 2) To Radio transmitting station: Approx. 1.6 km of 11kV overhead line 3) To Wilberforce line: Approx. 100 m of 11 kV overhead line (3) 11kV power distribution equipment & materials for the substations. 1) One (1) 500 kVA & one (1) 200 kVA transformers and two (2) of RMU (Ring Main Unit) 2) One (1) 315 kVA & one (1) 200 kVA transformers and two (2) of RMU (Ring Main Unit) (4) Procurement of spare parts for power distribution facilities & maintenance tools (5) Procurement of operation & maintenance manuals for power distribution facilities and implementation of OJT
Kingtom Power Station Extension Plan (Phase-2)	**3. Procurement & Installation of Following Equipment:** (1) Procurement & installation of 2 sets of diesel engine generator (DEGs) with output capacity of 5 MW each. (2) Procurement & installation of the following mechanical auxiliaries for the relevant power generating facilities Fuel oil supply system, lubricating oil system, air intake & exhaust gas system, cooling water system, compressed air system, sludge treatment system, piping system. (3) Procurement & installation of the following electrical equipment necessary for the relevant power generating facilities 1) Auxiliary equipment Generator control & monitoring panels, generator protection relays panel, LV motor control panel, DC power supply system 2) 11 kV high voltage electric equipment 11 kV high voltage panel, 11 / 0.415 kV station transformer, cabling & wiring, etc. (4) Procurement of spare parts for power generating facilities & auxiliary equipment and maintenance tools (5) Procurement of operation & maintenance manuals for power generating facilities & auxiliary equipment and implementation of OJT (On-the Job Training) **4. Building Construction Work** (1) Construction of a powerhouse (one story, partially two stories) with total floor approx. 1,087 m^2 (including building utilities) (2) Construction of foundations for DEG & auxiliary equipment.

2-2-2-3 Equipment and Facility Plan Overview

(1) Extension of Kingtom Power Station

The components of the generating system to be constructed at the Kingtom Power Station under the Project are described as follows. Schematic Specifications of facilities (systems) and equipment are shown in Table 2-2-2-3-(1).

1) Basic Items

① Selection of Generation System

A diesel engine generation system will be applied in due consideration of compatibility with the existing facilities in Sierra Leone, easy operation and maintenance and urgency.

② Fuel Composition

Heavy oil is presently utilized at the existing Kingtom Power station as main fuel and diesel oil is used for start-up and shut-down of engines. Fuel similar to fuel utilized in the generating equipment from previous assistance will be used for the generating system to be constructed under the Project and its gross calorific value is 40.9 MJ/kg.

③ Lubricating Oil Composition

Lubricating oil composition recommended by the engine manufactures varies. However, in a similar manner as fuel oil, lubricating oil for the existing power station is purchased from Shell in Sierra Leone and its type is SAE-40 and 30. However, since the revolution speed is 750 rpm or less, SAE-40 is recommendable.

④ Cooling Water (Coolant)

The city water in Freetown is utilized as coolant at the existing Kingtom Power Station and the total hardness of the water is 126 mg/ℓ (results of the Basic Design Study of the previous assistance). Compared with Japanese tap water standards (300 mg/ ℓ), although it can be utilized as drinking water, it is too hard for radiators and primary coolant cooler since scales might be adhering to the equipment. Consequently, in order to obtain 10 ppm or less of total hardness for the Project, a simple water softener will be installed so that tap water can be utilized as coolant.

2) Planned Components

① Engine Output and Generator Capacity

The output of the generating system to be installed under the Project will be decided in due consideration of the following factors.

(a) The target year will be 2012 which is three years after the completion of the Project (2009).

(b) Even if the largest-output generator (except for Bumbuna Hydroelectric Power), including the existing facilities, suspends its operation due to inspections or failure, a generating output that will secure power supply balance in the target year will be selected.

(c) A generating system which can be operated continuously as base load power plant (over 8,000-hour operation annually) will be selected.

Since peak demand in year 2012 is forecasted to be 56.9 MW, total generating capacity of 9.2 MW or more should be added by the Project so that the power supply capacity becomes greater than the peak demand even if the largest-output generator with the capacity of 6.4 MW is subtracted from the sum of total generating capacity of 54.1 MW other than the Project.

Since engine specifications, etc. vary according to manufacturer and are not the same or are slightly different, for the time being the following formula will be used as a yardstick.

• Engine Output

$$Pe \geqq \frac{P}{0.7355 \times \eta} = 7{,}553 \text{ PS}$$

Pe : Engine output (PS, meter horsepower)
P : Generator-end output (5,000 kW)
η : Generator efficiency (assumed to be 90%)

• Generator Capacity

$$P_G = \frac{P}{Pf} = 6{,}250 \text{ kVA}$$

P_G : Generator capacity (kVA)
P : Generator-end output (5,000 kW)
Pf : Generator power factor (0.8)

(d) For a generator with a base load of 5 MW, medium-speed equipment with an engine speed of 750 rpm or less is generally adopted and much operational experience is available. Accordingly, a medium-speed generator with an engine

speed of 750 rpm or less will be used for the diesel engine system to be installed under the Project.

② Mechanical Equipment Plan

a) Fuel Supply Plan

There is only one heavy oil tank of capacity 1,650m^3 at the Kingtom Power Station. When considering the generating output of the existing system, although the tank capacity is small, the NPA has own tank lorry so it is possible to supplement fuel when the occasion arises. Therefore, the existing fuel tank capacity is judged to be sufficient for supplying stable electrical power.

In order to remove impurities contained in heavy oil to be utilized under the Project, heavy oil transferred from the exiting fuel tank will be received by the buffer tank and its temperature will be increased using an electric heater unit installed in the tank. After impurities are removed by a heavy oil purifier unit, it will be supplied to the fuel service tank.

Fuel will be supplied to the engine using a fuel transfer pump from the fuel service tank. The fuel oil system is shown in Basic Design Drawing G-M02.

Heavy Oil Service Tank

The capacity of the heavy oil service tank must be calculated as follows in order for the relevant generating system to operate for approximately 2 hours.

$$Vs = V \times 5{,}000\ kW \times 2\ hours \fallingdotseq 2.2\ m^3$$

However,

Vs : Capacity of heavy oil service tank

V : Fuel consumption (210g/kWh) per generator (rated output of 5,000 kW) assuming the specific gravity of fuel to be 0.96

Accordingly, the nominal capacity of the heavy oil service tank will be 2.5 m^3 taking into consideration 15% dead space.

Diesel Oil Service Tank

A diesel oil service tank will be utilized when starting and stopping the diesel engine. The capacity of the diesel oil service tank will be the amount required to cover the time (1.5 hours) necessary to start and stop the diesel engine.

In a manner similar to the heavy oil service tank, it can be calculated as follows.

$Vs = V \times 5{,}000\ kW \times 1.5\ hours \fallingdotseq 1.9\ m^3$

However,

Vs : Capacity of diesel oil service tank

V : Fuel consumption (210g/kWh) per generator (rated output of 5,000 kW) assuming the specific gravity of fuel to be 0.85

Accordingly, the nominal capacity of the diesel oil service tank will be 2.2 m^3 taking into consideration approximately 15% dead space, which is nearly the same as the heavy oil service tank. The capacity will therefore be 2.5 m^3, which is the same as the heavy oil service tank.

b) Lubricating Oil System

Since there is no common (sharing) lubricating oil system at the relevant power station, a lubricating oil system exclusive to the relevant power station will be installed under the Project.

Lubricating oil will be provided to engines from a storage drum located outdoor the powerhouse through lubricating oil transfer pump. The lubricating oil system is shown in Basic Design Drawing No. G-M03.

c) Cooling Water system

As previously described [Refer to 1) (iv) in 2-2-2-3-(1)] , after city water stored in the existing city water tank is processed using a water softener (treatment) unit to improve hardness, it will be utilized as coolant. The radiator method same as the existing system constructed from previous assistance will be applied. Some of the water treated by the water softener will also be transferred to the heavy oil and lubricating oil purifier units.

The cooling water system is shown in Basic Design Drawing No. G-M04.

d) Compressed Air System

One compressed air system will be installed for each diesel engine to start-up under the Project. In addition, the said system will be connected to the compressed air systems each other for shared utilization during an emergency.

The compressed air system is shown in Basic Design Drawing No. G-M05.

Since humidity is high at the project site, an automatic drain valve will be installed in an air receiver. By dividing the secondary piping of the said air receiver into high pressure and low pressure, an air dryer will be installed in the low-pressured air system. The low pressure air system will provide compressed air to control units and the heavy oil and lubricating purifier units.

e) Air Intake and Exhaust Gas System

Necessary outside air will be brought in via an exclusive duct using a turbocharger and flue gas will be discharged to the outside via an exhaust gas silencer after combustion. The air intake and exhaust gas system is shown in Basic Design Drawing No. G-M06.

Four sets of blower will be installed in the blower room in order to cool generators and to prevent the temperature from rising in the DEG room; whereas, exhaust air will be discharged from an exhaust louver installed on the roof of the powerhouse.

f) Sludge Treatment System

The capacity of the existing sludge treatment system at the relevant power station is insufficient and could have an impact on the environment. The impact on the environment should be reduced by installing a separate sludge treatment system and waste oil incinerator under the Project. The sludge treatment system is shown in Basic Design Drawing No. G-M07.

g) Piping System

The piping necessary for the relevant generating system to be constructed outside includes the following types. Color coding should be applied to the piping for each operation and flow direction should be specified.

- Fuel oil piping
- Lubricating oil piping
- Cooling water piping
- Compressed air piping
- Waste oil piping
- Drainage piping

③ Electrical Facilities

In a similar manner as the existing system, the voltage of the generation system to be constructed under the Project will be 11 kV. This is economical because the step-up transformer is not necessary to be connected to the existing high voltage feeder panel (11 kV) and will also ensure compatibility with the existing system. In principle, a unit operating method is applied to the auxiliary equipment, and a minimum back-up system will be adopted even if one of the new generator units stops. The planned components for major electrical facilities are described as follows.

a) Local Control Panel

A local operation box (local control panel) will be installed on the generator side for starting, stopping and controlling the generation system and annunciation, etc.

b) Generator Control and Supervisory Panel

Generator control and supervisory panels will be installed in the electric room to collectively monitor the generating equipment, high voltage panels and the auxiliary equipment to be constructed under the Project. A control panel for excitation using a brushless thyrister method will be installed in generator control panel (GCP) and synchronizing operation of the generators will be started via this panel. Since the said panel has static mechanize built in, the installation of air conditioning should be taken into account for the electrical room.

c) Remote Supervisory Panel

A supervisory panel will be installed in the existing control room to indicate the output conditions of the generating system. This does not have a control function.

d) DC Power Supply

A direct current (DC) power supply unit will be installed in the electric room in the powerhouse to provide DC power for starting, stopping, controlling and measuring of the relevant generating equipment and auxiliary equipment and indicating alarms, etc. The voltage will be 110 V.

e) Low Voltage Power Panel

Low voltage power panels will be installed for supplying power to the auxiliary equipment of the generating system. Necessary switching mechanism, measuring instruments and alarms will be installed on these panels.

f) Grounding System

The Kingtom Power Station has adopted a common grounding system. Accordingly, the following grounding network will be connected via the existing grounding system to the relevant generating system.

- Grounding system for ground fault protection of the electric power system
- Grounding system for preventing electric shock from electrical equipment
- Lightning arrester system for protecting the facilities and equipment from lightening

g) Cabling System

Power and control cables from the new generating facilities to the existing 11 kV high voltage feeder panels and remote supervisory panels will be laid by utilizing cable pits and/or conduits already laid in the existing powerhouse.

In the pits, cable trays, etc. will be installed to allow easy maintenance of cables.

h) 11 kV High Voltage System

- 11 kV high voltage feeder panel

The 11 kV distribution circuit breaker panels will be installed in the electric room within the existing powerhouse. Operation switches and indicating lamps will be also installed in the said circuit breaker panels. Since the 11 kV panels will be installed next to the existing 11 kV panels, it is preferable that the shape and the dimension will be the same as the existing panels. Since the power supply for operating the 11 kV panels will be branched off from the existing panels, it will be DC 220 V; whereas, it will be 240 V for the space heater.

- Generator circuit breaker panel and station power panel

Generator circuit breaker panels and station power panel will be installed in the electric room. Operation switches and indicating lamps will be also installed in the said panels.

i) Generator Protective Relay Panel

Protection relay panels for generators will be installed in the electric room to control and monitor the “on and off” of each circuit breaker panels.

j) Station Transformer

Two (2) outdoor-type station transformers will be installed as a power source for auxiliary equipment of the relevant generators. The capacity of the transformer will be 630 kVA each, selected from the standard capacity of IEC Standard. The said transformers will be installed at outdoors and fireproof walls will be installed taking into consideration the extension of 11 kV and low voltage cables and maintainability.

k) Diesel Generator for Black Start

Even if all generators at the Kingtom Power Station are stopped, a mobile package-type diesel generator for providing the minimum power to the auxiliary equipment will be provided so that at least one diesel generator to be furnished under the Project can be started. The generator capacity will be the manufacturer's standard.

3) Outlines of Major Equipment

In due consideration of the above-mentioned design policy, design standard, facility and equipment layout plans, etc., the specifications for major generating equipment to be constructed under the Project will be formulated as follows.

Table 2-2-2-3-(1) Outlines of Major Equipment for Power Generating Facility

No.	Major Equipment Name	Schematic Specifications
1.	Diesel Engine	Operation rating : Continuous (base load) Output : More than 5,000 kW at generator-end Revolution speed : Not more than 750 rpm Engine type : 4 stroke cycle, trunk piston type, water cooled, inter-cooled, V-type diesel engine with turbocharger Cooling method : Radiator cooling Fuel oil : Heavy oil & diesel oil Other : Common bed with vibration damper
2.	Generator	Operation rating : Continuous Output : Not less than 6,250 kVA (5,000 kW) Frequency : 50 Hz Phase : 3 phase Rated voltage : 11 kV Frequency : Same as engine Power factor : 0.8 (lagging) Connection : Wye (Y) connection, neutral direct grounding Insulation class : F
3.	Mechanical System	
3.1 (1)	Fuel Oil Supply System Heavy Oil System ① Heavy Oil Transfer Pump	 Motor driven gear type & filter

No.	Major Equipment Name	Schematic Specifications
	② Heavy Oil Buffer Tank	Steel-plate product, 2.5 m^3, electrical heater
	③ Heavy Oil Filter	Washing type (not more than 20 ppm residual sodium)
	④ Heavy Oil Purifier Unit	Centrifuge type
	⑤ Heavy Oil Service Tank	Steel-plate product, 2.5 m^3, electrical heater
(2)	Diesel Oil Supply System	
	① Diesel Oil Transfer Pump	Motor driven gear type & filter
	② Diesel Oil Service Tank	Steel-plate product, 2.5 m^3
(3)	Common System	
	① Fuel Oil Flow Meter	Accuracy class of 0.5, filter included
	② Fuel Oil Filter	Single & duplex bucket type
	③ Fuel Change-over Valve	Self-operating type
	④ Line Heater	Electric type
	⑤ Viscosity Controller	Automatic control type
	⑥ Fuel Oil Drain Tank	200ℓ
	⑦ Fuel Oil Drain Pump	Motor driven gear type & filter
3.2	Lubricating Oil System	
	① Lubricating Oil Transfer Pump	Motor driven gear type & filter
	② Lubricating Oil Sump Tank	About 7 m^3
	③ Lubricating Oil Priming Pump	Including motor & gear pump
	④ Lubricating Oil Cooler	Plate type, including automatic temperature regulating valve
	⑤ Lubricating Oil Main Filter	Bucket type 50 μ , automatic backwashing unit
	⑥ Lubricating Oil Purifier Unit	Centrifuge type, automatic sludge discharge type included
	⑦ Pressure Regulating Valve	Air pressure operation type
	⑧ Turbocharger Lubricating Oil System	Sump tank, transfer pump, filter, cooler
3.3	Cooling Water System	
	① HT/LT Buffer Tank	Steel-plate product, 0.5 m^3
	② HT/LT Cooling Water Pump	Motor driven centrifugal type
	③ Temperature Control Valve	Self-operating type
	④ Radiator	2-stage type, vertical air flow fan, copper cooling pipe
	⑤ Secondary Coolant Pump	Motor driven centrifugal type
	⑥ Water Softener	Ion exchange resin type
	⑦ Softened Water Supply Pump	Motor driven centrifugal type
3.4	Compressed Air System	
	① Air Compressor	Pressure 25 kg/cm^2, electric motor drive
	② Air Receiver	Capacity for continuous 3-time engine starts, with automatic drain valve equipped
	③ Pressure Reducing valve	Self-operating type
	④ Air Dryer	Electric type
3.5	Air Intake & Exhaust Gas System	
	① Intake Air Duct	Steel-plate product, circle shape
	② Intake Air Filter	Automatic cleaning type
	③ Intake Air Silencer	Horizontal type
	④ Exhaust Air Silencer	Equipped with roof ventilator (air stack)
	⑤ Exhaust Air Duct	Steel-plate product, circle shape
	⑥ Blower Fan	Axial flow type
3.6	Sludge Treatment System	
	① Oil Water Separator Tank	Gravity type, about 2 m^3
	② Oily Water Pump	Motor driven screw pump, 0.5 m^3/hour
	③ Oily Water Separation Unit	Not more than 50 ppm residual oil
	④ Incinerator	0.5 m^3/hour, auxiliary fuel & waste oil tank equipped
4.	Electrical System	
	① 11 kV High Voltage Feeder Panel	11 kV circuit breaker, 630 A, 50 Hz, 20 kA (1 second)
	② Low Voltage Power Panel for Auxiliary Equipment	Self-standing type, control system included
	③ Generator Control Panel	Self-standing type, AVR panel & synchronizing panel included
	④ Generator Circuit Breaker Panel	11 kV circuit breaker, 630 A, 25 kA

No.	Major Equipment Name	Schematic Specifications
	⑤ Station Power Breaker	11 kV circuit breaker, 630 A, 25 kA
	⑥ Protective Relay Panel	For generating system
	⑦ DC Power Unit	Complete sealed lead storage battery, 110 V
	⑧ Station Transformer	Outdoor self-cooling type, 630 kVA 11 / 0.415 kV
	⑨ Generator for Black Start	415 / 240 V (capacity recommended by manufacturer)
	⑩ Remote Monitoring Panel	Desk type, monitoring for generating system

4) Powerhouse Construction Plan

① Outline of the Powerhouse

A new powerhouse will be constructed within the lot at the existing Kingtom Power Station and include the following components.

a) Powerhouse	One building	Steel-frame construction, partial 2-story building Approx. 632 m^2 of building area, approx. 1,087 m^2 of total floor area
b) Foundation	One set	Foundations for DEG, auxiliary equipment & electrical equipment, etc.
c) Outdoor work	One set	Rain water drainage, exterior lighting

② Lot and Facility Layout Plan

New powerhouse will be constructed at the premise of the center of the existing Kingtom Power Station and its size is approximately 48.6 m (from west to east) x 21.6 m (from north to south). If the size of the foundation and passageways, etc. is taken into account, it will be difficult to fully occupy the premise. Furthermore, there is no other space within the lot to construct the building. The existing powerhouse is located on the north side of the lot and in-plant roads are situated on the other three sides. Since the relevant lot is situated in almost the center, the impact of noise and vibration, etc. on the surrounding private homes is small.

③ Major Functions of the Powerhouse

The following rooms will be scheduled for the relevant generating facilities.

a) Generator Room

This room will accommodate two 5 MW generators and their auxiliary equipment. Its layout should be of a sufficient size for easy maintenance. Each

generator will be approximately 11 m long, 3 m wide and 4 m high (including common beds). The auxiliary equipment will include fuel and lubricating oil pumps, filters, air compressors, compressed air tank and waste oil tank, etc. The size of the plain surface will be 24.5 m x 16 m including an area for inspections and repair of parts to allow appropriate arrangement of the equipment. In addition, 5-ton crane (gantry type, pendant type) will be installed for repairing and inspecting engine parts.

b) Electric Room

This will be an electric room to accommodate generator monitoring panels, generator circuit breakers and station power panel, etc. and be simply arranged so as not to hinder maintenance. A window for inspection and monitoring will be installed on the wall adjoining the DEG room.

c) Blower Room

A blower system will be installed in the blower room to be used as a ventilating unit to bring in fresh air in order to prevent high temperatures in the DEG room due to heat generated from engines and generators.

d) Floor Area and Building Services of Major Rooms

Table 2-2-2-3-(2) Floor Area and Building Services

Room Name	Area (㎡)	Equipment
Sump Pit	343	Lighting, emergency lighting
Generator Room	392	Lighting (elevating type), emergency lighting, ventilation, automatic fire alarm, fire extinguisher
Electric Room	112	Lighting, emergency lighting, air conditioning, automatic fire alarm, fire extinguisher, intercom
Blower Room	112	Lighting, automatic fire alarm, fire extinguisher
Other	128	Lighting
Total	1,087	

e) Structure

Table 2-2-2-3-(3) Major Construction Specifications

Name	Construction Specifications
Foundation	Reinforced concrete, spread foundation
Slab, Pit for Piping & Cabling	Reinforced concrete
2nd floor	Concrete slab on deck plate
Column & Beam	Steel frame, zinc galvanizing finish

f) Exterior Finish

Table 2-2-2-3-(4) Exterior Finish

Name	Finish
Upper Roof, External Wall	Zinc-plated, colored and ribbed steel plate with insulation materials
Lower Roof	Membrane water proofing, protective concrete steel trowel
Retaining Wall	Concrete block paint finish

g) Interior Finish

Table 2-2-2-3-(5) Interior Finish

Name	Part	Finish
Sump Pit	Floor	Steel trowel finish
	Wall	Exposed concrete
	Ceiling	Exposed concrete
Generator Room	Floor	Steel trowel finish with oil-resistant paint finish
	Wall	Cement slate substrate, glass wool sound board on cement slate
	Ceiling	ditto
Electric Room	Floor	Steel trowel finish, anti-dust painting finish
	Wall	Painting finish on slate Painting finish on concrete block
	Ceiling	Rock wool board on plaster board substrate
Blower Room	Floor	Steel trowel finish
	Wall	Glass wool sound board on cement slate
	Ceiling	Glass wool sound board on cement slate substrate

④ Functions and Building Plan

The ceiling of the generator room will be high enough to allow the lifting of cylinders using a 5-ton maintenance crane to be installed on the ceiling in order to secure 7.0 m of lifting clearance.

⑤ Structural Design

a) Superstructure

Steel-frame construction will be applied to superstructures. Due to this structural style, the construction period can be shortened and building weight can be reduced, so as to lessen the burden on the foundation. It is also possible to build a large span without constructing columns in the generator room. Since the

proposed construction sites face the coast, the steel framework will be galvanized to increase a salt resistance.

b) Substructure

Based on the findings of the geological survey implemented at the proposed construction sites, site ground is mainly composed by slightly soft sand. In addition, the ground approximately 2 to 2.5 m from the surface is gravel stratum. Here, the existing generators were installed, so it is assumed that the loose soil on the ground surface was replaced by gravel for the installation of the generators.

As a sump pit is scheduled around the generators in the construction plan for the powerhouse, spread footing will be applied to the sand ground lower than the gravel stratum for the deep foundation and gravel stratum for the shallow foundations as supporting ground. As described in superstructure, a powerhouse will be constructed with steel frames in order to reduce burden on the foundation.

⑥ Building Services

Building services of major rooms are described as follows.

a) Lighting and Outlets

The JIS standards will be applied to illumination of indoor lighting. Fluorescent lights or mercury lamps will be adopted in principle as lighting equipment.

b) Air Conditioning

An air conditioning system will be installed in the electric room only.

c) Ventilation

Ventilation system by utilizing ventilating fans or vent in the generator room and electric room should be taken into account.

d) Fire Extinguishing and Automatic Fire Alarm System

As the initial fire extinguishing, an ABC type fire extinguisher (10 kg) will be arranged in the generator and electric rooms. Since there are inflammables such as fuel and lubricating oil in the generator room, a foam extinguisher (20 ℓ) will be installed. In addition, smoke-sensor type automatic fire alarm will be installed in

each room in order to show any fire on the receiver panel in the control room on the 2nd floor of the existing powerhouse.

e) Crane

In the Project, a 5-ton overhead crane capable of lifting large parts such as cylinders will be installed for engine maintenance.

f) Equipment Foundation

The foundation for the diesel engine generators, the auxiliary equipment and electric installation, etc. will be constructed.

(2) Freetown Distribution Network Improvement

1) Basic Items

In the case of selecting equipment and materials necessary for constructing substations, easy operation and maintenance and the safety after the completion of substations should be taken into account. Basically the NPA personnel will supervise and control the substation equipment to be installed under the Project, so lighting units will be installed outside to carry out appropriate supervision.

The 33/11 kV distribution transformers and high voltage panels will be designed in due consideration of the weather conditions at the project sites. By considering the safety for local residents, fences around substations and transformers will be installed.

An underground cabling or overhead wiring method (partially common use of poles with the existing low voltage distribution lines is applied) will be applied to the 33 kV and 11 kV distribution lines will be adopted in due consideration of the following matters as an occasion demands.

- There are some areas where it is difficult to secure the existing “Right of Way (land exclusively for roads)” due to narrow road width.
- Special consideration should be taken to areas where a distribution line-to-ground fault might occur due to contact of quick-growing trees in order to prevent accidents before they happen.
- If there are areas with the existing 11 kV distribution lines, new lines should be constructed in the same routes as much as possible to promote simple maintenance.

2) Contents of the Plan

The contents of the plan on distribution network improvement in Freetown are described as follows.

① Construction of 33 kV Regent Primary Substation

Major Items:
- 33 kV and 11 kV indoor-type feeder panel 1 set
- Distribution transformer (33 / 11 kV, 5 MVA) 1 unit
- Station transformer (11 kV/415-240 V, 630 kVA) 1 unit
- Other necessary auxiliary equipment and foundations 1 set

② Construction of 33 kV Distribution Lines between Regent Primary Substation and Wilberforce Primary Substation

(a) Laying of 33 kV underground cables (approximately 3.2 km)

(b) Laying of 33 kV overhead lines (approximately 1.3 km)

(c) Installation of 33 kV indoor-type feeder panel (1 set) at Wilberforce Primary Substation (next to the existing panel)

③ Construction of 11 kV Distribution Lines

(a) Between Kingtom Power Station and Congo Cross Primary Substation :

i) Overhead distribution line : Approximately 3.3 km

ii) Underground cable : Approximately 0.5 km

iii) 11 kV feeder panel : 1 set (installed in electric room at Kingtom Power Station)

(b) Between Congo Cross Primary Substation and Wilberforce Primary Substation :

i) Overhead distribution line : Approximately 2.5 km

④ Procurement of Materials for 11 kV Distribution Lines

(a) Falcon Bridge Primary Substation and Blackhall Road Primary Substation

i) Overhead distribution line : Approximately 0.8 km

ii) Underground cable : Approximately 2.6 km

(b) Between Regent Primary Substation and the below-mentioned distribution substation

i) Guma Water Reservoir : Approximately 1.3 km

ii) Radio Station : Approximately 1.6 km

iii) Wilberforce Line : Approximately 100 m

(c) Construction of Distribution Substations

i) Guma Water Reservoir : Transformer (1 unit of 500 kVA , 1 unit of 200 kVA), 2 sets of RMU, 2 sets of low voltage feeder panels

ii) Radio Station : Transformer (1 unit of 315 kVA , 1 unit of 200 kVA), 2 sets of RMU, 2 sets of low voltage feeder panels

⑤ Procurement of Maintenance Tools and Spare Parts for Distribution Lines

3) Schematic Specifications of Major Equipment

3-1) Equipment for Regent Primary Substation

① Overview of 33/11 kV Transformers

a) Capacity

An appropriate capacity of 33/11 kV distribution transformers to be installed at the Regent Primary Substation will be selected in the transformer standard capacity in due consideration of the load power factor (0.85) based on the maximum power demand after 5 years have elapsed (in 2014) after the completion of the Project. By considering a change in loads, a transformer equipped with on-load tap changer will be adopted. As mentioned above, the specifications of major transformer to be installed at the substation in the project site are described as follows.

Table 2-2-2-3-(6) Major Transformer Specifications

Substation Name	Demand in Target Year (2014)		33 / 11 kV Distribution Transformer (kVA)
	Peak Demand (kW)	Required Capacity (kVA) (Peak Demand ÷ Power Factor 0.85)	
33 kV Regent Primary Substation	3,600	4,200	5,000

b) Function

The on-load tap changer will be installed on 33 kV side of the main transformer (voltage adjustment range +5% to-15%, 1.25%× +4, -12 tap） for the purpose of lowering voltage down.

② Overview of 33 kV Initial Power Receiving System

Underground cables for 33 kV distribution lines will be drawn into 33 kV high voltage panels. Distribution circuit breaker (equipped with vacuum circuit breaker, 35 kV, 630A, 25kA and synchronizer), measuring instruments and protective relays, etc. will be equipped on the 33 kV feeder panel.

③ Overview of 11 kV Distribution System

The 11 kV distribution system will be composed of circuits to be drawn from the 33/11 kV distribution transformers and distribution feeders.

Circuit breakers (vacuum circuit breaker, 12 kV, 630 A, 20 kA, 1 second), measuring instruments, protective relays, low voltage AC power unit for substation control and DC power unit (capacity for 60-minute blackout time) will be equipped on the said feeder panel.

Since overhead wiring was partially adopted in the existing 11 kV distribution lines, a re-closing method will be applied to each 11 kA distribution feeder to ensure the reliability of power supply through a circuit breaker on the distribution side is re-closed automatically at the time of a minor ground fault.

④ Overview of Station Equipment

At the substations to be constructed under the Project, outdoor lighting will be an automatic lighting type equipped with a photo cell in due consideration of energy saving and easy operation. Specifications of high voltage cables to be connected between transformers at the substations are described as follows.

Table 2-2-2-3-(7) Specifications of Connecting Cables at Substations

Section	Cable Specifications	Remarks
33 kV Feeder Panel － Existing 33 kV Transmission Lines	18/30 (36) kV, 3-core copper conductor, 95mm^2, XLPE insulation, PVC sheath, armored	• To satisfy 18 MVA of line capacity
33 kV Feeder Panel － Main Transformer (33 kV side)	Same as above	
11 kV Feeder Panel － Existing 11 kV Transmission Lines	6/10 (12) kV, 3-core copper conductor, 185mm^2, XLPE insulation, PVC sheath, armored	• To satisfy 6 MVA of line capacity
11 kV Feeder Panel － Main Transformer (11 kV side)	Same as above	

(Note) XLPE：Cross-linked Polyethylene, PVC：Polyvinyl Chloride

⑤ Substation Construction Plan

The contents of a construction for the Regent Primary Substation to be built under the Project are shown in Table 2-2-2-3-(8).

Table 2-2-2-3-(8) Description of 33 kV Regent Primary Substation

No.	Item／Equipment	Specifications	Quantity
1.	Auxiliary Equipment Construction		
(1)	Outdoor Lighting	Sodium Lamp, 250 W, 6 m at height, equipped with separate photo cell	1 set
(2)	Fence & Gate		1 set
(3)	Cable Pit & Rain Water Drainage, etc.	Including oil water separate tank	1 set
(4)	Foundations for Main Transformer & High Voltage Panel		1 set
2.	Main Transformer Procurement & Installation		1 unit
(1)	Model	Outdoor type, self-cooling oil filing, on-load tap changer, 12 kV, 10 kA arrester installed in cable box, 3-phase integrated serge counter equipped	
(2)	Rated Capacity／Voltage	5 MVA, 33 / 11 kV, 3-phase	
(3)	Applicable Standards	IEC/JEC	
3.	33 kV High Voltage Panel Procurement & Installation		3 sets
(1)	Model	Indoor sealed type, air insulation type, vacuum circuit breaker, 36 kV, 630 A, 25 kA 1 second, drawer type, equipped with synchronizer & earthing device	
(2)	33 kV High Voltage Panel Procurement & Installation	IEC/JIS/JEM	
4.	11 kV High Voltage Panel Procurement & Installation		
(1)	Model	Indoor sealed type, air insulation type, vacuum circuit breaker, drawer type	
(2)	Applicable Standards	IEC/JIS/JEM	
(3)	Breakdown	1) For incoming (12 kV, 630 A, 20 kA, 1 second)	1 set
		2) For distribution (12 kV, 630 A, 20 kA, 1 second)	4 sets
		3) For station transformer (12 kV, 630 A, 20 kA, 1 second), equipped with earthing device	1 set

No.	Item／Equipment	Specifications	Quantity
5.	Low Voltage Panel Procurement & Installation		1 set
(1)	Model	Indoor sealed type, air insulation type	
(2)	Applicable Standards	IEC/JIS/JEM	
(3)	Battery	Total sealed type alkaline battery 110 V (Blackout time : 1 hour), equipped with DC switchboard	
6.	11 kV Line Switch Procurement	(For connecting systems)	4 sets
(1)	Model	Indoor type, vertical 1 point cut, equipped with ground operating rod	
(2)	Rated Voltage & Current	12 kV/600 A (20 kA)	
(3)	Applicable Standards	JIS/JEC/JEM	
7.	11 kV Arrester Procurement	(For connecting systems)	12 pieces
(1)	Model	Indoor type, gapless type, equipped with 3-phase surge counter	(1 piece/phase)
(2)	Rated Voltage	12 kV	
(3)	Discharge Current	10 kA	
(4)	Applicable Standards	IEC	
8.	33 kV Power Cable Procurement & Installation	(For connecting systems & station use)	1 set
(1)	Model	18/30 (36) kV 3-core copper-conductor cable, XLPE insulation, PVC sheath, armored	
(2)	Applicable Standards	IEC	
(3)	Size	95 mm^2 (3-core)	
(4)	Accessories	Termination materials, etc.	
9.	11 kV Power Cable Procurement (for connecting distribution lines)	(For connecting systems & station use)	1 set
(1)	Model	6/10 (12) kV 3-core copper-conductor cable, XLPE insulation, PVC sheath, armored	
(2)	Applicable Standards	IEC	
(3)	Size	70 mm^2 (3 core)	
(4)	Accessories	Termination materials, etc.	
10.	Low Voltage & Control Cable, etc. Procurement & Installation	(For station use)	1 set
(1)	Power Cable	600 V XLPE insulation, PVC sheath, cooper-conductor cable	
(2)	Control Cable	600 V PVC insulation, PVC sheath, cooper-conductor cable	
(3)	Miscellaneous Wiring Work Materials	Including grounding work materials	

3-2) 33 / 11 kV Distribution Lines

① Route Selection

By examining drawings on the existing distribution lines and telephone lines, etc. obtained from the NPA and investigating actual spots with the NPA engineers, routes per area to be installed distribution lines were decided after confirming obstacles on the route. Basic routes are shown in 3-2-3 Basic Design Drawings.

② Types of Conductors for Distribution Lines

The NPA standard specifications will be applied to conductors to be utilized for underground and overhead distribution lines under the Project and are described in the following table.

Table 2-2-2-3-(9) Specifications of Conductors for 33 / 11 kV Distribution Lines

Item	Cable Specifications	Remarks
33 kV Overhead Line	Steel-cored aluminum conductor, 120mm^2	To satisfy 455 A (25 MVA) of line capacity
33 kV Underground Line	18/30 (36) kV, copper conductor, XLPE insulation, PVC sheath, 95mm^2 (3-core), armored	To satisfy 18 MVA of line capacity
11 kV Overhead Line	Hard-drawn aluminum alloy wire, 120mm^2	To satisfy 455 A (8.7 MVA) of line capacity
11 kV Underground line	6/10 (12) kV, 3-core copper conductor, 185mm^2, XLPE insulation, PVC sheath, armored	To satisfy 6 MVA of line capacity

(Note) XLPE: Cross-linked Polyethylene, PVC: Polyvinyl Chloride

The quantity of conductors for distribution lines to be procured will be calculated by multiplying 1.05 of allowance ratio (ratio of supplementation in construction: 5%) by plain distance (design quantity) to be measured based on a drawing. The quantity of planned installation work will be calculated by multiplying 1.03 of allowance ratio by a design quantity. Accordingly, the quantity of 33 kV and 11 kV distribution lines to be constructed or procured under the Project is shown in Table 2-2-2-3-(10).

Table 2-2-2-3-(10) Quantity of 33 / 11 kV Distribution Lines

(Unit: m)

No.	Item	33 kV (Overhead / Buried)	11 kV (Overhead / Buried)
1.	① Design Quantity	1,300 / 3,200	9,600 / 3,100
2.	② Planned Procurement Quantity (①×1.05)	1,370 / 3,360	10,100 / 3,260
3.	③ Planned Installation Work Quantity (①×1.03)	1,340 / 3,340	9,900 / 3,200

③ Laying Method

Although 33 kV and 11 kV distribution cables to be procured under the Project will be buried directly under the ground, those in road intersections will be buried in conduits in due consideration of the maintainability. Earth covering depth will be 1.0 m in principle and a cable buried indication sheet will lay on the upper part of a cable to be buried (approximately 30 cm under the ground). The underground routes will be the side of carriageway (Right of Way: land exclusively for road) and be located within 10 m from the center of a road in accordance with the NPA standards.

④ Maintenance

A cable fault locator will be provided for easy rehabilitation at the time of accidents of underground lines.

2-2-3 Basic Design Drawings (Refer to attached materials)

	Drawing No.	Drawing Name
Master Plan	G-E00	Freetown 11 / 33 kV Network
Kingtom Power Station	G-G01	General Arrangement
	G-G02	Arrangement of Generating Facilities
	G-A05	New Powerhouse Elevation
	G-E01	Kingtom Power Station Key Single Line Diagram
	G-M00	Key Flow Diagram
	G-M02	Fuel Oil Flow Diagram
	G-M03	Lubricating Oil Flow Diagram
	G-M04	Cooling Water Flow Diagram
	G-M05	Compressed Air Flow Diagram
	G-M06	Air Intake and Exhaust Gas Flow Diagram
	G-M07	Sludge Treatment Flow Diagram
Distribution Plan • Substation	D-G01	33 kV Route Map between Wilberforce and Regent S/S
	D-G02	11 kV Route Map among Kingtom P/S, Congo Cross and Wilberforce S/S
	D-G03	11 kV Route Map between Falcon Bridge and Blackhall Road S/S
	D-G11	Regent S/S: General Arrangement
	D-E11	Single Line Diagram: Regent S/S

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project will be implemented in accordance with the Japan's Grant Aid scheme. Accordingly, its implementation will only take place after Project approval by the Government of Japan and the Exchange of Notes (E/N) between both governments. The basic issues and points to note in the process of implementing the Project are described as follows.

(1) Project Implementation Body

The competent and supervisory agency for implementation of the Project on the Sierra Leonean side is the Ministry of Energy and Power (MEP). National Power Authority (NPA) under the supervision of the said ministry is the executing agency for the Project and will carry out operation and maintenance of the relevant facilities. Consequently, the MEP and the NPA will be required to appoint a person responsible for the Project who will stay in close contact with the Japanese consultant and equipment suppliers in order to ensure its smooth implementation.

The above-mentioned responsible person will be required to provide guidance to staff of the power generation and distribution divisions and residents in Freetown in order to obtain cooperation for the implementation of the Project based on a full understanding after sufficiently explaining the contents of the Project.

(2) Consultant

A Japanese consultant will conclude a consulting services agreement with the Government of Sierra Leone and will provide a detailed design work supervision pertaining to the Project in order to implement equipment procurement and installation work under the Project. The consultant will also prepare tender documents and conduct pre-qualification and tenders for the NPA, the Project implementation body.

(3) Equipment Suppliers

In accordance with the Japan's Grant Aid scheme, an equipment supplier of a Japanese juridical person selected by the Sierra Leonean side through competitive tendering will carry out the procurement of equipment and materials and installation work.

As it is deemed necessary that the contract to provide aftersales service including continuous supply of spare parts and an appropriate response to breakdowns even after completing the Project, the equipment supplier should provide adequate liaison and adjustment after handing over the relevant equipment and materials.

(4) Necessity for Dispatch of Japanese Engineers

Since the construction for the power station under the Project is work to carry out installation work of the power generating facilities in the existing power station in operation, it is necessary to adjust with the existing facilities such as the foundations and powerhouse and to coordinate and adjust to existing equipment such as control systems. In addition, the construction of substations and laying work of power transmission and distribution lines will be carried out in residential areas where many of the general public reside or along national roads where traffic is heavy. Consequently, it is also important to dispatch a site manager who is able to consistently control and lead the construction work in order to ensure schedule control, quality and safety.

Since there are few technicians who have sufficient skill in large-sized power generating facility construction within the foundations of civil engineering in Sierra Leone, Japanese engineers should be dispatched from equipment suppliers for quality control and schedule control. Furthermore, installation work for equipment at the relevant power generation facilities and substations requires extensive knowledge and expertise in the equipment function and framing

(constitution). Accordingly, experts should be dispatched from equipment manufacturers during the installation of the relevant equipment, test runs and adjustment.

2-2-4-2 Implementation Conditions

(1) Construction Conditions in Sierra Leone

Although it is possible to ensure workers (laborers) involved in construction work in Sierra Leone, few skilled workers or engineers have expertise in process control, quality control and safety control. Consequently, Japanese equipment suppliers should dispatch engineers or skilled workers from Japan when needed.

(2) Important Considerations for a Work Plan

1) Since the mean monthly rainfall at the relevant site over the past thirty (30) years has been 9.5 mm at the minimum in January and 805.6 mm at the maximum in August, rain falls throughout the year. Accordingly, special consideration should be given to process planning for excavation work or high-voltage cable terminal treatment work by formulating a plan for rain cover or rain water drainage.

2) Since the installation of the power generating equipment will be completed in a work period prescribed in accordance with a framework of Japan's Grant Aid scheme, it will be carried out in line with the construction of a powerhouse, construction of mechanical and electrical installations. In the case of connecting with existing generating facilities, the impact of power blackouts on local residents should be minimized and its process shortened.

3) In the case of implementing distribution line construction, a work plan should be formulated in order to minimize the impact of power blackouts and road traffic restrictions, etc on the public.

4) In the case of excavation for underground cables, special attention should be given to buried sewerage pipes and telephone lines, and at the same time, a process should be scheduled to prevent any overlapping during the construction period with extension of telephone lines.

5) In the construction of the powerhouse, since installation work of the generating equipment, building finishing and utility work will be synchronized in order to strictly meet the construction period as contracted, daily safety control should be taken into account.

6) Construction work associated with the cutting down of existing trees down, its timing and cutting scale, etc. should be confirmed with the NPA in advance to obtain confirmation from concerned authorities and local residents, avoiding environmental destruction or civil problems.

2-2-4-3 Scope of Work

The work demarcation between the Japanese and Sierra Leonean sides is shown in Table 2-2-4-3-(1).

The materials warehouse within the Kingtom Power Station will be utilized to store spare parts and maintenance tools for the power generating equipment to be procured under the Project. In addition, it is recommended that spare parts and maintenance tools for substation equipment be stored in the warehouse within the NPA's Blackhall Road Primary Substation.

Table 2-2-4-3-(1) Work Demarcation of the Project

Work Item	Equipment Procurement		Installation Work, etc.		Remarks
	Japan	Sierra Leone	Japan	Sierra Leone	
A. Power Generating System					
1. Diesel Engine Generators	○		○		Rated output 5 MW×2 units
2. Auxiliary Equipment for Diesel Engine					
(1) Heavy Oil Supply System	○		○		Subject to connecting flange of the existing heavy oil supply pipe & its subsequent system
(2) Diesel Oil Supply System	○		○		Subject to the existing diesel engine oil supply pipe & its subsequent system
(3) Lubricating Oil System	○		○		
(4) Cooling Water System	○		○		
(5) Compressed Air System	○		○		
(6) Air Intake & Exhaust Gas System	○		○		
(7) Sludge Treatment System & Incinerator	○		○		
(8) Piping System	○		○		
3. Auxiliary Electrical Equipment for Diesel Engine					
(1) Control & Protective Panels on equipment side (installed in the electrical room)	○		○		A central control monitor panel will be installed in the existing control room.
(2) 11 kV Circuit Breaker	○		○		
(3) Station Transformer	○		○		
(4) Auxiliary Power Panel	○		○		
(5) Cabling System	○		○		
4. Fire Detector & Fire Extinguishing Equipment	○		○		
5. Spare Parts (for 2-year portion)	○			○*1	*1 Storage
6. Maintenance Tools, Testing Instruments	○			○*1	*1 Storage
7. Completion Test	○		○		
8. On-the –Job Training (OJT)	○*2		○*3	○*4	*2 Teaching Materials, *3 Providing Training, *4 Taking Lectures
9. Site Preparation (including removal the existing foundations & transfer of pipes)		○		○*5	○*5 To be completed before work by Japan begins
B. 33 / 11 kV Distribution System					
1. Construction of New 33 kV Distribution Lines from Wilberforce Primary Substation to Regent Primary Substation	○		○		Including 33 kV feeder panel at Wilberforce Primary Substation
2. Construction of New Regent Primary Substation	○		○		Including step-down transformer (33/11 kV, 5 MVA), circuit breaker
3. Construction of New 11kV Distribution Line from Kingtom Power Station to Congo Cross Primary Substation	○		○		Including 11 kV feeder panel at Kingtom Power Station

Work Item	Equipment Procurement		Installation Work, etc.		Remarks
	Japan	Sierra Leone	Japan	Sierra Leone	
4. Construction of New 11kV Distribution Line from Congo Cross Primary Substation to Wilberforce Primary Substation	○		○		
5. Construction of New 11kV Distribution Line from Falcon Bridge Primary Substation to Blakhall Road Primary Substation	○			○	
6. 11 kV Distribution Lines form Regent Primary Substation to Guma Water Reservoir	○			○	
7. Spare Parts & Maintenance Tools (including cable fault point detector)	○			○*6	*6 Storage
8. Repair for Doors & Fences at Existing Substations		○		○	
9. Lot Acquisition & Ground Leveling at Regent Primary Substation				○	
10. Prior Notice to Consumers who are affected by construction		○		○	
11. Completion Test	○		○		
12. OJT	○*7		○*8	○*9	*7 Teaching materials, *8 Providing Training, *9 Taking Lectures
C. Construction of New 415-240 V Distribution Lines (Items related to the above-mentioned B)					
1. Conductors, Distribution Panels, etc.		○		○	Including watt-hour meter
2. Completion Test		○		○	
3. Spare Parts		○		○	
D. Powerhouse Construction					
1. Roads for Construction, Site Preparation		○		○	
2. Construction of Powerhouse	○		○		
3. Air Conditioning, Electricity, Telecommunications, Plumbing Systems, etc.	○		○		
4. Foundations for Generating Equipment	○		○		
5. Rain Water Drainage System	○		○		
6. Furniture		○		○	
E. Temporary Construction, etc.					
1. Temporary Construction for Temporary Offices, etc.	○		○		
2. Temporary NPA Office during Construction		○		○	
3. Lot for Materials Storage, Temporary Offices		○			Materials warehouse 2,000 m^2
4. Doors & Fences for Materials Storage at Substations		○		○	
5. Electricity, Water & Telephone Charges for Construction	○		○		
6. Fuel & Lubricating Oil until No-load Test of Generating Equipment	○		○		
7. Fuel & Lubricating Oil after No-load Test of Generating Equipment		○		○	

Note: ○ denotes side responsible for the work.

2-2-4-4 Consultant Supervision

In due consideration of the Japan's Grant Aid scheme and the objectives of the basic design, the consultant is responsible for smooth implementation of the work after creating a project team. The consultant will dispatch at least one full-time engineer to the project site to conduct schedule, quality and safety control during the construction period. The consultant will also dispatch other engineers in line with the work progress of equipment installation, test runs and adjustment, and completion testing of the equipment before handing over and supervise construction work to be conducted by equipment suppliers.

Moreover, as an occasion arises, the consultant will oversee that an engineer participates in witnessing factory inspections and a pre-shipment inspections of equipment to be produced in Japan or a third country in order to prevent any problems after the equipment and materials are delivered to the project site.

(1) Basic Principles of Work Supervision

The consultant will supervise the work progress to ensure the completion of the construction work within the predetermined period and will supervise and guide equipment suppliers to ensure quality described in an agreement and safe implementation of the construction work in principle.

Major points to be noted in the case of work supervisor are described as follows.

1) Schedule Control

The consultant will compare the actual progress of the following work items with the schedule to be planned by an equipment supplier at the time of a contract on a weekly and monthly basis. If any delay is foreseen, the consultant should issue a warning to the equipment supplier and request the supplier to submit recommended countermeasures so that the construction work can be completed within the agreed period.

① Confirmation of quantity of work completed
② Confirmation of quantity of equipment delivered
③ Confirmation of actual number of engineers, skilled workers and laborers and their ratio compared with the original plan

2) Quality Control

The consultant will determine whether or not the quality of the facilities and equipment specified in the contract documents (such as technical specifications and detailed design

drawings) has been ensured based on the following items. If some doubt exists on whether or not quality has been secured, the consultant should ask the equipment supplier to make corrections, changes or modifications.

① Check shop drawings and specifications of equipment and materials
② Check results of a factory inspection of equipment and materials and witness of inspections
③ Check installation manuals, field trial runs and adjustment, inspection manuals and shop drawings of equipment and materials
④ Supervise on-site installation work of equipment and materials and witness of trial runs, adjustment and inspections
⑤ Check facility work drawings
⑥ Comparison between work drawings and completed work at the site

3) Safety Control

The consultant will supervise in order to prevent any industrial injuries and accidents at the site during the construction period before they happen through consultations with representatives of equipment suppliers. The key points for on-site safety control are described as follows.

① Prepare safety control rules and appointment of a safety manager
② Prevent accidents by carrying out periodical inspections of construction machinery
③ Formulate operational routes for construction vehicles and machinery, etc. and strict enforcement of careful and safe driving
④ Enforce welfare measures and holidays for workers

(2) Project Implementation System

An interrelationship between participants in the implementation of the Project including the work supervision period is shown in the following figure.

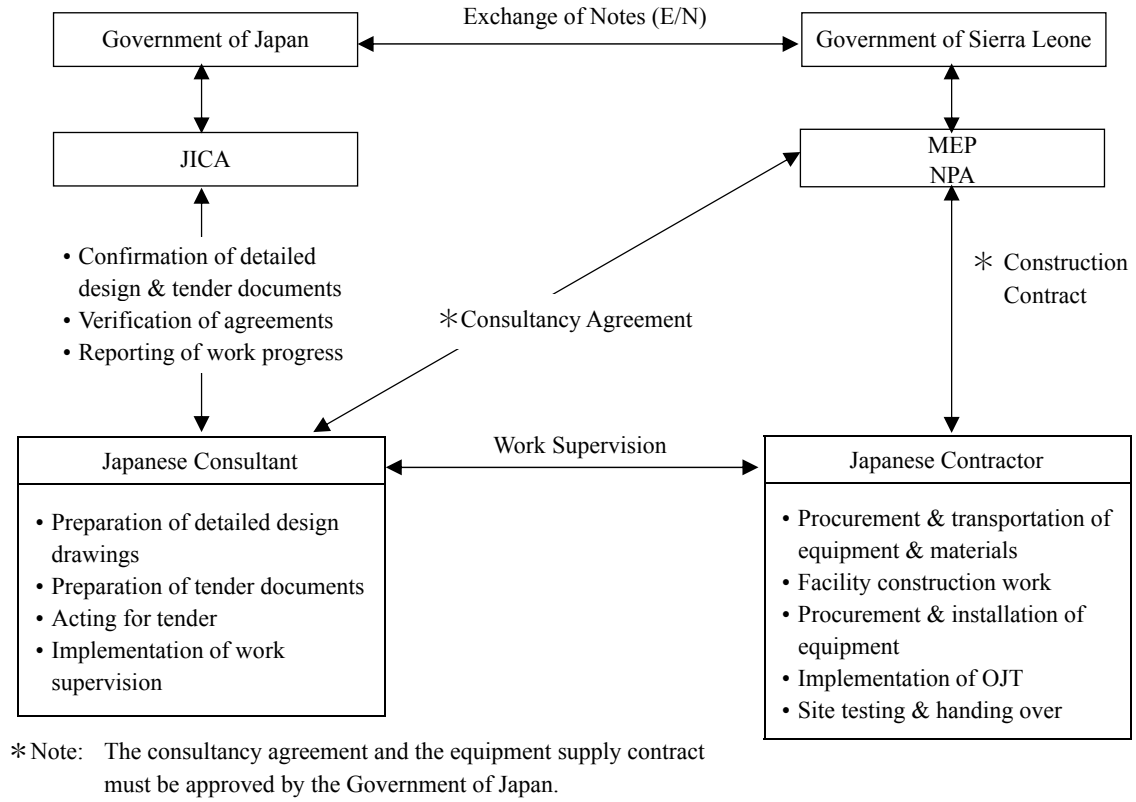


Figure 2-2-4-4-(1) Project Implementation System

(3) Work Supervisors (Supervising Engineers)

In the case of implementing facility construction work and equipment installation work in accordance with a construction agreement, a contractor will hire local contractor(s) in Sierra Leone through a subcontract agreement. Accordingly, in order for a contractor to fully understand the contents of schedule control, quality control and safety control during a construction period, a contractor should dispatch Japanese engineers who have experience in similar overseas projects so that the contractor can provide good management.

2-2-4-5 Quality Control Plan

A work supervisor of the consultant will determine whether or not the quality of facilities, equipment and materials specified in contract documents (such as technical specifications and detailed design drawings) has been secured by a contractor based on the following items. If some doubt exists on whether or not quality has been secured, the consultant should ask the contractor make corrections, changes or modifications.

① Check shop drawings and specifications of equipment and materials
② Witness factory inspections for equipment and materials and check factory inspection results

③ Check method of packaging and transportation and method of on-site temporary storage
④ Check working drawings of equipment and installation manuals
⑤ Check trial runs and adjustment at a factory and at sites related to equipment and materials and inspection manuals
⑥ Supervise on-site installation work for equipment and witness trial runs, adjustment and inspections
⑦ Check facility working drawings and completed work at the site
⑧ Check completed building drawings

2-2-4-6 Procurement Plan

Almost all the construction materials to be utilized and equipment to be procured under the Project are not produced or manufactured in Sierra Leone and are imported from overseas. Although some raw materials (such as cement, quarrying and sand) are available on the market in Sierra Leone, it is difficult to guarantee delivery dates and quality of other materials, so they will be procured from Japan or a third country.

(1) Power Generation System

As the originating countries for manufacturing power generation equipment, Japan and European nations have joined the Development Assistance Committee (DAC). In Europe, there are several manufacturers of power generation equipment which satisfy the specifications required under the Project and transportation distance is close, making it geographically advantageous. However, it is possible that the delivery date may not conform to the schedule of the Japanese Grant Aid scheme and the after sales services system is judged to be imperfect based on the existing generators at the Kingtom Power Station.

On the other hand, No. 6 DEG (5 MW, 1 unit, Japanese product) at the Kingtom Power Station procured through the previous Japan's grant aid project has been continuously operated without suspension of operation for periodical inspections due to the constant lack of electricity in Freetown; however, the NPA is strongly requesting that Japanese products be procured under the Project based on their operation results and durability, the degree of satisfaction toward the after services system of the manufacturer, and the degree acquired of operation and maintenance skills related to Japanese-produced generating equipment. With regards to delivery date, generating equipment produced in Japan will conform to the schedule of the Japanese Grant Aid scheme. Based on the above-mentioned conditions, Japanese-produced generating equipment is favored for the Project. Of the auxiliary equipment for the generator system, since European products such as radiators, lubricating oil purifier units and heavy oil viscosity controllers are generally

incorporated into the system even by Japanese generator manufactures, DAC member countries will be adopted as the country of origin under the Project.

(2) Transforming and Distribution System

Since much of the equipment and materials for power distribution systems presently adopted by the NPA are European products, not only feeder panels or transformers but also cables or electric poles and insulators used in Sierra Leone are imported. Accordingly, the NPA staffs are well informed about the handling of these products, for the consultant, it is recommended that DAC member countries be adopted as qualified nations.

As described above, the country origins of equipment and materials under the Project are shown as follows.

Table 2-2-4-6-(1) Country Origins of Equipment and Materials

Equipment & Materials	Procurement Source		
	Sierra Leon	Japan	Third Country (Refer to Note)
(Oils)			
① Fuel oil, coolant	○	-	-
② Lubricating oil	○	-	-
(Construction Materials)			
① Sand, gravel	○	-	-
② Cement	○	-	-
③ Ready-mixed concrete	○	-	-
④ Steel products	-	○	○
⑤ Steel frame	-	○	○
⑥ Building utility, finishing materials	-	○	○
(Construction Machinery & Transportation Vehicles)			
① General construction machinery	○	-	-
② Special construction machinery & transportation vehicles (cranes, low-slung trailers, mobile lifts)	-	○	○*1
(Kingtom Power Station)			
① Diesel engine, generators	-	○	-
② Auxiliary equipment for the above (such as fuel supply system, cooling water system & compressed air system)	-	○	○
③ Piping system for the above & accessories	-	○	○
④ Electric installations for generating system (such as generator panel, transformer & power control panel)	-	○	○
⑤ 11 kV indoor-type feeder panel	-	-	○
⑥ Electric installation materials (such as 1 kV cables, low voltage cables, conduit pipes & accessories)	-	○	○
⑦ Spare parts & maintenance tools for electric installation for diesel engine generating system)	-	○	-
(Freetown Distribution Lines Improvement)			
① 33 kV & 11 kV feeder panels	-	○	○
② Low voltage switchboards	-	○	○
③ 33 & 11 kV distribution transformers	-	○	○
④ Electric installation materials (such as 33 kV overhead lines, underground conductors & accessories)	-	○	○
⑤ Electric installation materials (such as 11 kV overhead lines, underground conductors, low voltage cables, conduit pipes & accessories)	-	○	○
⑥ Spare parts & maintenance tools for distribution lines	-	○	○

Note: Third countries are regarded to be DAC member nations.
*1 Special construction machinery and transportation vehicles will be procured from neighboring countries.

2-2-4-7 Operation Guidance Plan

The power generating facilities subject to the Project are relatively large, for example 5 MW output for a single unit. In addition, problems frequently occur at the existing generating facilities. In order to promote smooth operation after the start of service, an on-the-job training (OJT) plan necessary for the construction work period and trial runs will be recommended.

(1) OJT Plan During Installation Work and Trial Runs

1) OJT Objectives

Skills on operation and maintenance of the facilities and equipment to be procured and installed under the Project will be transferred to the counterpart (C/P) on the Sierra Leonean side during installation work and trial runs.

Specifications and grades of the generating facilities and equipment to be introduced under the Project will be selected in due consideration of the existing technical level of the NPA involved in the operation and maintenance of existing facilities. In addition, to the some extent the NPA has operation and maintenance skills in the Japanese-produced diesel engine generating system based on experience gained from operation and maintenance from the previous assistance. However, since some of the power generating system to be procured under the Project will include the introduction of new technology after delivering the existing generating facilities, engineers who are to be dispatched from manufacturers will carry out on-the-job training (OJT) on operation and maintenance skills to engineers in Sierra Leone.

Furthermore, in order to minimize the impact on the environment, guidance on waste oil disposal including a recommendation for rehabilitation of the existing facilities will be provided. At the same time, training on an operation method for various instruments indispensable to maintenance operations will be carried out so as to ensure effective application of the furnished equipment.

(2) Contents of the Plan

1) Period and Location of OJT Implementation

- Lecture : Approximately 1 week (on-site)
- On-site practical training : Approximately 2 months (on-site)

① Instructor

Engineers specialized in equipment installation, trial runs and adjustment to be dispatched from manufacturers of the generating system to be delivered by the relevant Japanese equipment supplier will be instructors.

② Trainees

As trainees on the Sierra Leonean side who take the OJT will be operation and maintenance personnel at the NPA who will be directly involved in operation and maintenance work, the following personnel will receive OJT. Accordingly, the NPA and the implementing agency of the Project on the Sierra Leonean side will appoint trainees in a concrete manner prior to the start of installation of the generating system.

－Chief Engineer	:	1 person		
－Operation Staff	:	Electrical engineer	:	1 person
		Mechanical engineer	:	1 person
		Electrical skilled worker	:	2 persons
		Mechanical skilled worker	:	2 persons
		Subtotal	:	6 persons
－Maintenance Staff	:	Electrical engineer	:	1 person
		Mechanical engineer	:	1 person
		Electrical skilled worker	:	2 persons
		Mechanical skilled worker	:	3 persons
		Subtotal	:	7 persons
		Total	:	13 persons

③ Training Contents

－Lecture

By utilizing operation and maintenance (O/M) manuals, the following basic education mainly in the relevant power generating system will be provided.

- Characteristics and structure, etc. of the relevant generating system
- Basics on operation and maintenance (schedule and control, basic concept on preventive maintenance, equipment functions, basics on countermeasures for accidents and faults, spare parts and tools control, drawings and documents management)

• System and management practice of sludge treatment equipment

－On-site Practical Training

Equipment suppliers on the Japanese side will carry out the following items and contents of the training will be carried out at the actual spot during installation work and trial runs.

• Method to disconnect and fix (service) cylinder heads

• Method to dismantle and service fuel valves

• Method to finish air intake and exhaust valves using a grinder

• Method to dismantle and service pistons

• Method to disconnect and inspect crankpin bearings

• Method to service electric pumps

• Method to maintain air cleaners and filters

• Method to maintain sludge treatment system

• Method to start up and stop

• Method to stop at the time of faults and emergency

• Method of monitoring and visual inspections

• Method to maintain the piping and cabling

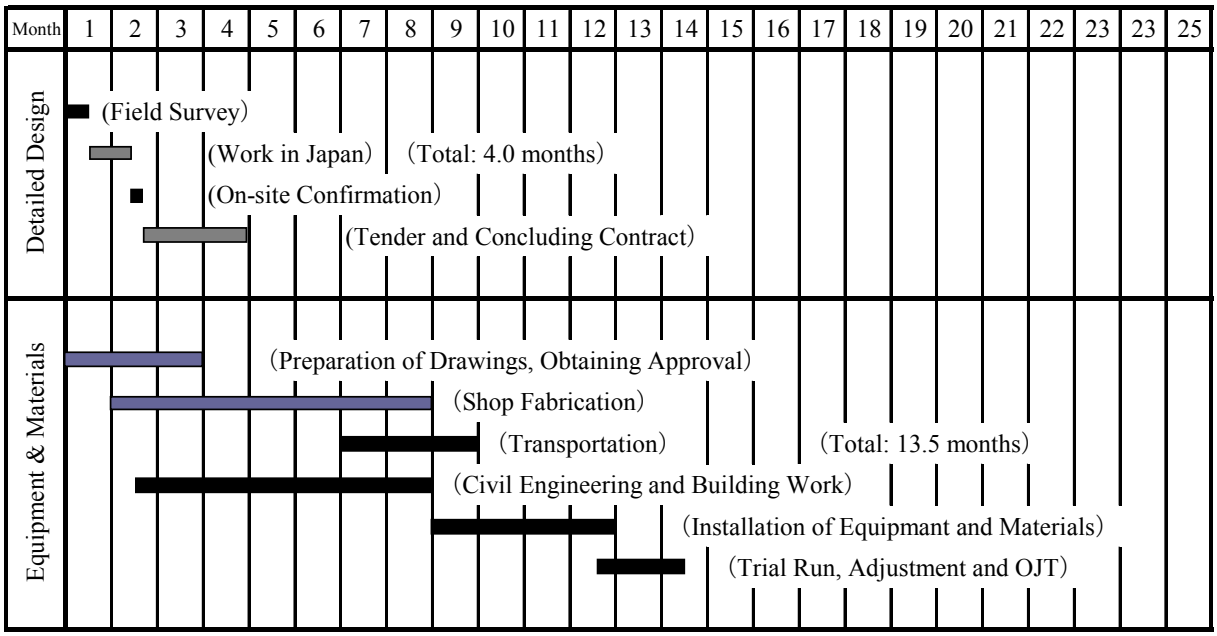
• Method to maintain electric installations

2-2-4-8 Implementation Schedule

In accordance with the Japan's Grand Aid scheme, the implementation of the Project will begin with the signing of Exchange of Notes (E/N) between both countries after the Government of Japan approves its implementation. The implementation of the Project is roughly comprised of 3 stages: (i) preparation of a detailed design and tender specifications, (ii) tender and construction agreements and (iii) procurement and installation of facilities and equipment.

The project implementation schedule is shown in Figure 2-2-4-8-(1).

(Phase-1: Improvement of Freetown Distribution Network)



(Phase-2 : Extension of Kingtom Power Station)

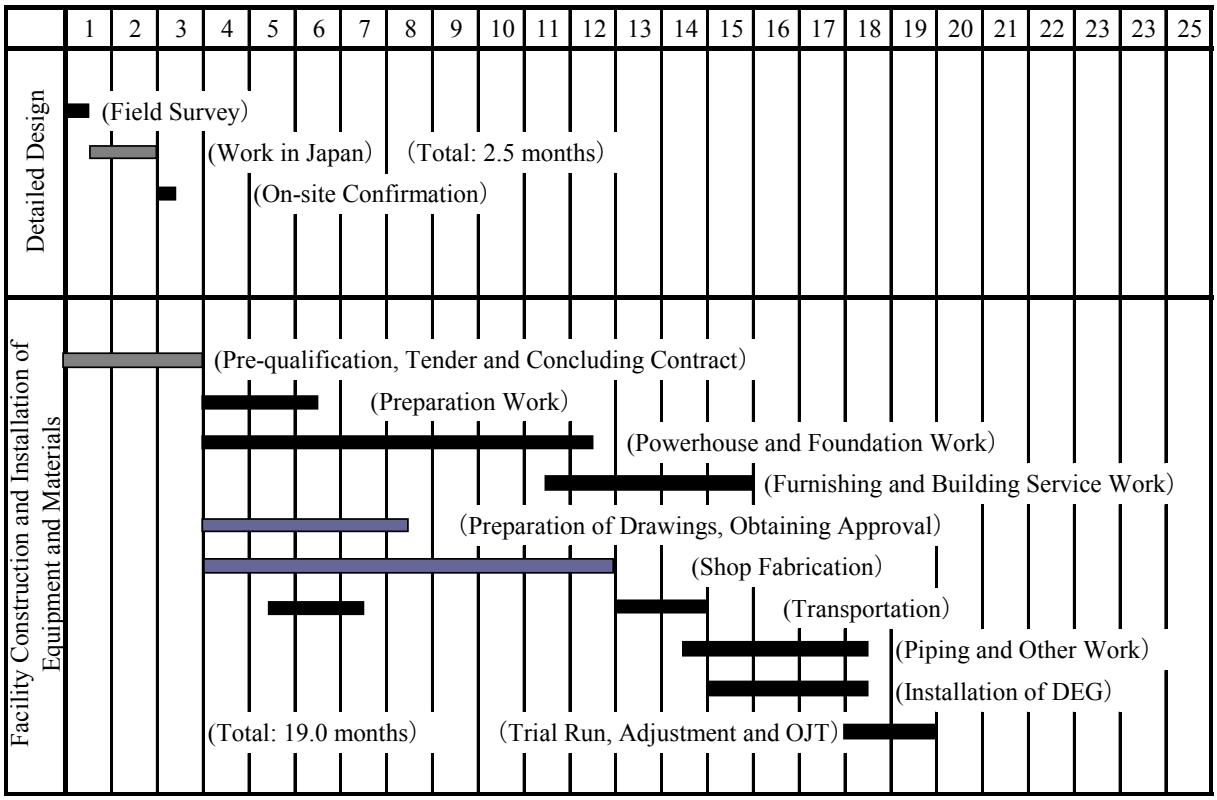


Figure 2-2-4-8-(1) Project Implementation Schedule

2-3 Obligations of Recipient Country

In the case of implementing the Project, apart from the work responsibilities of the Sierra Leonean side as shown in 2-3-4-3 “Scope of Work”, work items will be implemented and undertaken by the Sierra Leonean side are described as follows.

Common Items

(1) To provide necessary data and information for the Project.

(2) To ensure speedy unloading custom clearance and tax exemption of goods for the Project at ports and airports in Sierra Leone.

(3) To accord dispatched Japanese nationals whose services may be required in connection with the supply of products and services under verified contracts for necessary entry and stay in Sierra Leone therein in the performance of work.

(4) To exempt Japanese nationals from custom duties, local taxes and other fiscal levies which may be imposed in Sierra Leone with respect to the supply of products and services under verified contracts.

(5) To bear expenses for opening a bank account and service charges of a Japanese bank authorized as a foreign exchange bank banking arrangement.

(6) To bear all expenses other than those borne by the Japan's Grant Aid scheme necessary in the implementation of the Project.

(7) To appoint exclusive engineers for transferring operation and maintenance skills of the Project, to confirm the construction during a construction period and to witness quality inspections of the equipment and materials.

(8) To use and maintain properly and effectively all equipment and materials to be constructed and procured through the Japan's Grant Aid scheme.

Kingtom Power Station Extension

(9) To remove the existing foundations at the Kingtom Power Station prior to the start of the construction work by the Japanese side.

(10) To renovate existing access roads to the Kingtom Power Station prior to the start of construction work by the Japanese side

(11) To offer a temporary lot for construction offices and warehouse for equipment and materials, etc. free of charge

(12) To offer a place for disposing remaining soil, waste water and waste oil during a construction period

(13) To ensure power blackouts at the time of connecting equipment and materials to be provided under the Project to the existing high voltage panels, transformers and fuel pipes, etc.

(14) To arrange load at the time of load testing to be implemented during the construction period

Freetown Distribution Network Improvement

(15) To level proposed site for constructing the substation, to construct access roads and to remove or transfer the existing structures

(16) To offer a temporary lot for construction offices and warehouse for equipment and materials, etc. free of charge

(17) To remove or transfer existing buried objects

(18) To install the equipment and materials of 11 kV distribution lines to be provided by the Japanese side and to connect those to the existing 11 kV distribution lines (the connection work should be completed prior to the completion of construction work by the Japanese side)

(19) To review and readjust the existing protective relay system

(20) To carry out the construction of all low voltage distribution lines

2-4 Project Operation Plan

2-4-1 Basic Concept

The power generating system is the most important facility to be maintained under the Project. In the case of its maintenance, in order to supply stable electric power according to a change in daily power demand, operation and maintenance (O/M) of the system and preservation of the system environment is indispensable.

In order for the relevant generating system to maintain capacity and functions and to ensure stable power supply, it is desirable to carry out appropriate preventive maintenance and control by improving the reliability, safety and efficiency of the power generating facilities and equipment.

The basic concept of such a maintenance regime is shown in Figure 2-4-1-(1).

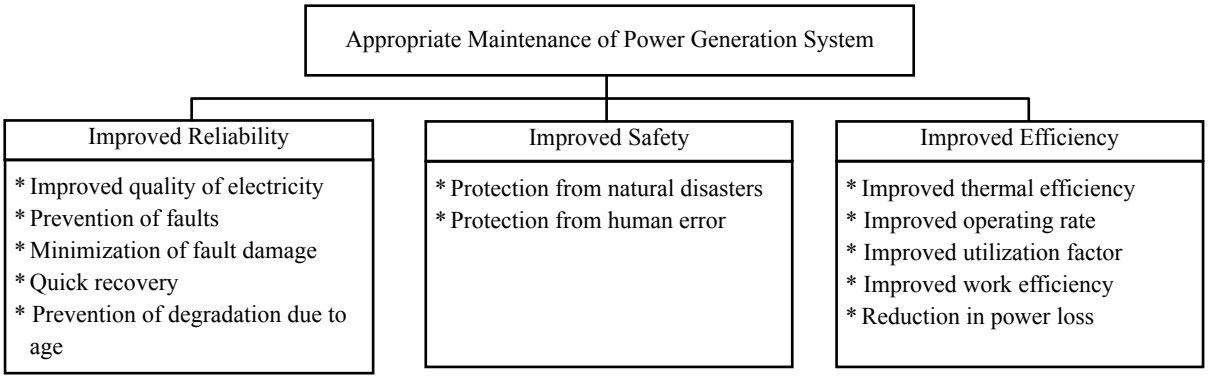


Figure 2-4-1-(1) Basic Concept for Power Generation System Maintenance

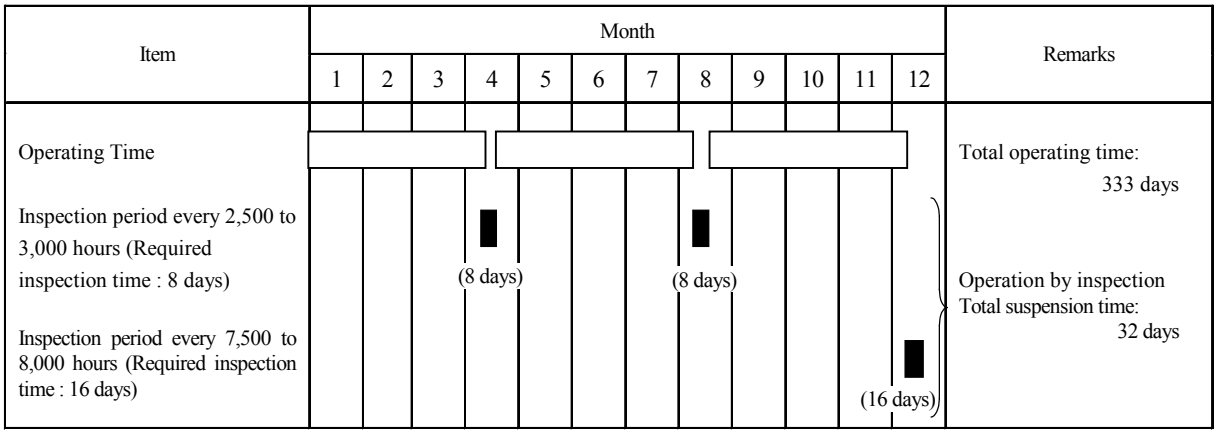
It is necessary to carry out operation and maintenance after the completion of the Project based on the O & M skills to be transferred through the OJT by specialized experts dispatched from Japanese equipment suppliers during the construction period and the O & M manuals through the Sierra Leonean side constantly bears the above-mentioned basic concept in mind.

2-4-2 Operation Plan on the Relevant Power Generating System

As the relevant power generating system will be a base for providing electric power in Freetown, the center of politics and economy in Sierra Leone, it is justifiable to set up an operation plan for the relevant generating system under the following conditions.

Annual utilization factor : Approximately 90%
Annual operating time : Approximately 8,000 hours

Periodical inspection items necessary for appropriate operation of the relevant power generating system are shown in Table 2-4-3-(1). In due consideration of the periodical inspection items, an annual operation plan in the first year of the relevant power generating system under the above-mentioned operating conditions is shown in Figure 2-4-2-(1). As shown in the said figure, the relevant power generating system anticipates stopping its operation for approximately 32 days in a year for its maintenance. With respect to power supply during the said period, the No. 6 equipment at the Kingtom Power Station or the existing power generating facility should be effectively utilized as substitute power source.



Remarks : Shows in the case of 90% of operating rate.

Figure 2-4-2-(1) Annual Operation Plan of the Relevant Power Generating System

2-4-3 Periodical Inspection Items

(1) Power Generation System

Based on the standard periodical inspection items of the relevant equipment as shown in Table 2-4-3-(1) and an operation and maintenance manual to be submitted by a power generator manufacturer, a plan to economical operation to meet power demand should be formulated by preparing an operation and maintenance plan of the power generating system.

Table 2-4-3-(1) Periodical Inspection Items of Standard Power Generation Equipment

	Inspection Category	Major Work Item
Diesel Engine	Daily (every day) Inspection	－Fuel oil level, lubricating sump tank oil level －Confirmation of jacket water level －Confirmation of start-up air tank pressure －Inspection of appearance of each part
	Inspection every 1,000 Hours	－Confirmation of clamping conditions of bolts & nuts －Fuel & lubricating oil filter cleaning
	Inspection every 2,500 to 3,000 hours	－Confirmation of operating conditions & oil leakage of air intake & exhaust valves, starting valves, fuel valves, fuel pumps, pistons & liners, etc. oil analysis of lubricating oil sump tank
	Inspection every 7,500 to 8,000 Hours	－Confirmation of operating conditions & oil leakage of pistons & cylinder liners, replacement of gaskets －Replacement of piston rings, oil rings, O-rings －Dismantling of cylinder head, replacement of piston rings & O-rings －Inspection of air intake & exhaust valves, replacement of exhaust valve O-rings －Inspection of fuel injection valves, replacement of nozzles －Inspection of crank pin bearings, necessary replacement －Dismantling & inspection of superchargers, replacement of bearings, etc. －Oil analysis of lubricating oil sump tank, replacement of lubricating oil at need
	Inspection per 16,000 hours	－Inspection of the above mentioned every 7,500 to 8,000 hours －Inspection of main guide bearings, necessary replacement －Inspection of exhaust valves, necessary replacement －Dismantling & inspection of lubricating oil pumps equipped with engines, necessary replacement
Generator	Daily (every day during operation) Inspection	－Visual inspection, confirmation of abnormal sound & temperature of each part
	Monthly Inspection	－Presence of abnormal vibration －Confirmation of lubricating oil flow & oil leakage on bearings －Necessary cleaning of each part
	Annual Inspection	－Measurement of insulation resistance & inspection of lead wires & terminals －Visual inspection of accessories such as space heaters －Visual inspection of bearings, necessary cleaning

The rough number of days required for the above-mentioned standard periodical inspection listed as follows.

- Inspection per 2,500 to 3,000 : 7 to 8 days /time
- Inspection per 7,500 to 8,000 : 15 to 18 days /time
- Inspection per 16,500 hours : 20 to 25 days /time

(2) Power Distribution and Substation Equipment

① Periodical Inspection of Power Distribution and Substation equipment

The standard periodical inspection items for the power distribution and substation equipment to be procured and installed under the Project are shown in Table 2-4-3-(2). As shown in the said table, inspections of the distribution system can be classified into 3 categories.

(a) “Patrolling inspection” to check every day through the five senses of human being such as abnormal sound of equipment

(b) “Ordinary inspection” to check energized parts which cannot be checked by daily patrolling inspection such as heat of bolts, clamping conditions and damage conditions on the surface of insulators

(c) “Detailed inspection” to check functions of interlock, etc. and to carry out accurate maintenance of instruments

In general, an ordinary inspection and a detailed inspection are respectively implemented once every 1 to 2 years and once every 4 years. It is also desirable to replace parts that deteriorate performance and insulating property, wear contact points and change characteristics such as electric fuses built in circuit breakers and feeder panels, instruments and relays as an occasion demands after confirming characteristics and frequency of utilization of parts.

Table 2-4-3-(2) Periodical Inspection Items of Standard Distribution and Substation Equipment

Item	Description (Method)	Patrolling Inspection	Ordinary Inspection	Detailed Inspection
Appearance	Indicating conditions of switch indicators, indicating lamps	○	○	
	Presence of abnormal noise, abnormal odors	○	○	
	Presence of discoloration by heat on terminals	○	○	
	Presence of crack or & damage of bushing & porcelain tube, damage condition	○	○	
	Rust conditions of installed cases & footstools	○	○	
	Presence of abnormal temperature (heat gage)	○	○	
	Clamping conditions of bushing terminal (mechanical check)	○	○	
Operating Unit & Control Panel	Indicating conditions of various instruments	○	○	○
	Indication of operation counter		○	○
	Presence of moist in operation boxes & panels, rust, damage conditions		○	○
	Oil level, cleaning conditions		○	○
	Clamping conditions of terminals on distribution lines	○	○	○
	Confirmation of switch indication		○	○
	Presence of air or oil leakage		○	○
	Confirmation of pressure before & after operation (such as air pressure)		○	○
	Confirmation of actuating of operating units		○	○
	Presence of rust, deformity or damage of springs (repair)	○	○	○
	Presence of abnormality of all clamping pins		○	○
	Inspection (repair) of auxiliary switches & relays		○	○
	Inspection of DC control power source	○		
Measuring & Testing	Measurement of insulation resistance		○	○
	Measurement of contact resistance			○
	Presence of heater disconnection		○	○
	Performance test of relays		○	○

② Periodical Inspection of Distribution Lines

The most important service for consumers is to detect an accident, damage or breakdown spot through daily patrol inspection and to immediately carry out rehabilitation work. Inspection items at the time of daily patrolling inspection are listed as follows.

a) Presence of contact of distribution equipment with trees, etc.

b) Confirmation of fence and lock system conditions

c) Confirmation of circuit breaker panels and switchboards conditions

2-4-4 Fuel Oil Procurement Plan

On the assumption of 90% of equipment utilization ratio, an annual consumption of fuel (heavy and diesel oil) necessary for operating the power generating system to be procured under the Project is estimated to be approximately 7,800 m^3/year.

At the present time, the NPA procures fuel for the Kingtom Power Station from a storage of a private oil company in Sierra Leone in accordance with the tendering results. In the similar manner with the existing generating facilities, the NPA should formulate a procurement plan for necessary fuel in order not to hinder stable operation of the relevant generating system.

2-4-5 Spare Parts Purchase Plan

Spare parts for power generation, distribution and substation equipment can be classified into standards accessories which are replaced according to an operation time and spare parts which are replaced at the emergency time such as breakdown or accident. Accordingly, the Sierra Leonean side should purchase those spare parts to meet a periodical inspection cycle.

The Project plans to procure spare parts necessary for initial full-scale periodical inspection after 16,000-hour (approximately 2 year later) operation and necessary spare parts until such the periodical inspection. Based on the periodical inspection items, major spare parts are listed in Table 2-4-5-(1).

Consequently, the Sierra Leonean side should prepare expenses for purchasing standard accessories until approximately 2 years later (approximately 3% of expenses on power generation, distribution and substation equipment) and necessary expenses for purchasing emergency spare parts.

Table 2-4-5-(1) Spare Parts and Maintenance Tools to be Procured under the Project

I -1. Spare Parts for Generation System

No.	Item	Quantity	Remarks
1.	Cylinder Cover		
	① Packing, O-Ring, etc.	2 sets×Cylinder×2 units	
	② Gasket Packing	2 sets×Cylinder×2 units	Emergency
	③ Packing (Intake Air)	2 sets×Cylinder×2 units	Spare Part
	④ Cylinder Cover Complete (including various valves)	1 set	(ESP)
2.	Intake Valve		
	① Funnel Cap	1 set×Cylinder×2 units	
	② Valve Spindle	1 set×Cylinder×2 units	
	③ O-Ring	2 sets×Cylinder×2 units	
	④ Intake Valve Complete	2 sets	ESP
3.	Exhaust Valve		
	① Valve Spindle	1 set×Cylinder×2 units	
	② Sleeve	1 set×Cylinder×2 units	
	③ Valve Seat	1 set×Cylinder×2 units	
	④ O-Ring	2 sets×Cylinder×2 units	
	⑤ Funnel Cap	1 set×Cylinder×2 units	
	⑥ Exhaust Valve Complete	1 set	ESP
4.	Fuel Injection Valve		
	① Nozzle Chip	2 sets×Cylinder×2 units	
	② O-Ring	2 sets×Cylinder×2 units	
	③ Fuel Injection Valve Complete	4 sets	ESP
5.	Piston		
	① Piston Ring	2 sets×Cylinder×2 units	
	② Oil Ring	2 sets×Cylinder×2 units	
	③ Piston Pin Bearing	1 set×Cylinder×2 units	
	④ Piston Head Fastening Bolt	1 set×Cylinder×2 units	
	⑤ O-Ring	2 sets×Cylinder×2 units	
	⑥ Piston Complete	1 set	ESP
6.	Connecting Rod		
	① Crank Pin Bearing	1 set×Cylinder×2 units	
	② Fastening Bolt	1 set×Cylinder×2 units	
7.	Main Bearing		
	① Main Bearing	1 set×Cylinder×2 units	
	② Thrust Bearing	2 sets×2 units	
8.	Cylinder Liner	2 sets	ESP
9.	Fuel Injection Pump		
	① Plunger Sleeve	2 sets×Cylinder×2 units	
	② Complete Injection Valve	1 set×Cylinder	ESP
	③ Deflector	2 sets×Cylinder×2 units	
	④ O-Ring	2 sets×Cylinder×2 units	
	⑤ Fuel Injection Pump Complete	2 sets	ESP
10.	Turbo Charger		
	① Bearing	2 sets×2 units	
	② Thrust Bearing	2 sets×2 units	
11.	Air Cooler		
	① Packing	2 sets×2 units	
12.	Starting Valve		
	① Packing	2 sets×Cylinder×2 units	
	② Starting Valve Complete	2 sets	ESP

No.	Item	Quantity	Remarks
13.	Cylinder Safety Valve		
	① Packing	2 sets×Cylinder×2 units	
	② Complete Cylinder Safety Valve	2 sets	ESP
14.	Indicator Valve Complete	1 set×Cylinder×2 units	
15.	Intake Expansion Pipe	1 set×Cylinder×2 units	
16.	Exhaust Expansion Pipe	1 set×Cylinder×2 units	
17.	Fuel Injection Pipe	2 set×Cylinder×2 units	
18.	Filter Element		
	① Intake Air System	100%	
	② Diesel Oil System	100%	
	③ Heavy Oil System	100%	
	④ Lubricating Oil System	100%	
	⑤ Compressed Air System	100%	
19.	Heavy / Lubricating Oil Purifier Unit	For Heavy / Lubricating Oil	
	① Mechanical Seal for Pump	100%×2 / 100%×2	
	② Packing for Pump	Same as above	
	③ O-Ring	Same as above	
	④ Packing	Same as above	
	⑤ Clipping	Same as above	
	⑥ Valve Plug	Same as above	
	⑦ Maintenance Tools	1 set / 1 set	
20.	Water Softer (Ion Exchange Resin)	1 set	
21.	Instrumentation Parts		
	① Pressure Switch	One of each kind	ESP
	② Temperature Switch	One of each kind	ESP
	③ Pressure Gauge	One of each kind	ESP
	④ Temperature Gauge	One of each kind	ESP
22.	Auxiliary Equipment Pumps		
	① Fuel Oil Circulating Pump	1 set	ESP
	② Lubricating Oil Priming Pump	1 set	ESP
	③ HT Cooling Water Pump	1 set	ESP
	④ Fuel Oil Drain Pump	1 set	ESP
	⑤ Sludge Pump	1 set	ESP
	⑥ Waste Oil Pump	1 set	ESP
	⑦ LT Cooling Pump	1 set	ESP
	⑧ Spare Parts for Auxiliary Pumps (Packing, O-Ring)	1 set×2 units	
	⑨ Spare Parts for Oily Water Separation Unit	1 set	
	⑩ Packing for Cooler	100%×2 units	
23.	Spare Parts for Electrical Equipment		
	1) Fuse for Low Voltage Circuits	200%	
	2) Fuse for High Voltage Circuits	200%	
	3) Lamp, Bulb	200%	
	4) Auxiliary Relay	1 set of each kind	ESP
	5) Fluorescent Light, Glow Lamp	200%	
	6) Various MCCB	1 set of each kind	ESP

Ⅰ-2. Spare Parts for Distribution and Substation Equipment

No.	Item	Quantity	Remarks
(1)	Consumables		
	1) Fuse for Low Voltage Circuits (Various)	200% of each kind	
	2) Lamp (Various)	200% of each kind	
	3) Indicating Lamp, bulb (Various)	200% of each kind	
	4) Fluorescent Light, Glow Lamp for Panels	200% of each kind	
	5) Silicagel (2 kg)	100% (each transformer)	
(2)	Emergency Spare Parts		
	1) Circuit Breaker	33kV、11kV each 1 set	3 Phase
	2) Arrester	33kV、11kV each 1 set	3 Phase
	3) Disconnector	33kV、11kV each 1 set	3 Phase
	4) Auxiliary Relay	1 set	
	5) MCCB (Various)	1 set	
	6) Fuse for High/Low Voltage Circuits	200%	
	7) 11 kV Cable Termination Kit	1 set	
	8) 33 kV Cable Termination Kit	1 set	

Ⅱ-1. Maintenance Tools (For Generating System)

No.	Item	Quantity	Remarks
1.	Maintenance Tools (for standard, special engine)	1 set	
2.	Special Tools for Generator	1 set	
3.	Spanner for Generator	1 set	
4.	Grinder (for exhaust valve)	1 set	
5.	Grinder (for exhaust valve sheet)	1 set	
6.	Lubricating Oil Analyzer	1 set	
7.	Water Analyzer	1 set	
8.	Tool Box (steel)	1 set	
9.	Measuring Instruments	1 set	
10.	Hand Pallet (1.5 t)	1 set	
11.	Ladder (2-step type)	1 set	
12.	Chain Block (1 t×2.5 m、2.5 t×3 m)	One of each kind	
13.	Hanging Wire (6 mm, 8 mm, 10 mm. 14 mm)	1 set	
14.	Testing Instruments		
	1) AC Clamp Meter	1 set	
	2) Digital Multi Tester	1 set	
	3) Voltage Detector (for HV/LV)	1 set	
	4) Megger (500 V,1000 MΩ)	1 set	
	5) Megger (1000 V,2000 MΩ)	1 set	
	6) Phase Rotation Meter	1 set	
	7) Portable Earthing Resistance Tester	1 set	
	8) Test Plug for Relay	1 set	
	9) Test Plug for Terminal	1 set	
	10) DC High Voltage Tester (for 33 kV Cable)	1 set	

Ⅱ-2. Maintenance Tools (For Distribution and Substation Equipment)

No.	Item	Quantity
		Regent Primary Substation
1.	Testing instruments	
	(1) Analog Tester	1 unit (common to 4 sites)
	(2) Simple Single-phase Relay Tester	1 unit (common to 4 sites)
	(3) Megger 500 V, 1000 MΩ	1 piece
	(4) Megger 2500 V,100 GΩ	1 piece
	(5) Portable Earthing Resistance Tester	Each 1 piece
	(6) Phase Rotation Meter	2 pieces (common to 4 sites)
	(7) Low Voltage Detector	1 piece
	(8) Voltage Detector for 33 kV	1 piece
	(9) Digital Multi Tester	1 piece (common to 4 sites)
	(10) AC Clamp Meter	1 piece
	(11) Cable Fault Detector	1 piece
	(12) Vacuum Checker	1 piece (common to 4 sites)
2.	Tools	
	(1) Hand Tool Set	2 sets
	(2) Grounding Tool Set (3-phase)	1 set
	(3) Cable Drum Jack (for 5 t)	1 set
	(4) Compressor (with dice)	1 set
	(5) Connecting Tool	1 set
	(6) Wire Stripper	1 set
	(7) Cable Cutter	1 set

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The total project cost in the case of the implementation of the Project with grant aid of the Government of Japan is estimated to be approximately ¥2,241 million. The breakdown of the cost based on the division of work between the Japanese and Sierra Leonean sides is outlined here based on the estimation conditions listed in (3) below. However, this estimated project cost is a provisional figure and is not necessarily the ceiling for grant aid agreed upon in the E/N. This figure will be further scrutinised at the time of examining the actual implementation of the Project.

(1) Japanese Portion Estimated Project Cost: Approximately ¥2,222 million

Cost Item		Estimated Project Cost (¥million)		
		Improvement of Freetown Distribution Network	Extension of Kingtom P/S	Total
Facilities	• Powerhouse at Kingtom Power Station • Foundations for DEGs and auxiliary systems	—	265	265
Equipment	• DEGs (5 MW x 2) • Auxiliary systems (fuel oil, lubricating oil, air intake and exhaust, cooling water, compressed air and sludge treatment systems) • Electrical equipment and in-house electrical equipment • Spare parts and maintenance tools	—	1,332	1,332
	• 33 kV Regent substation • 33/11 kV distribution lines • 11 kV distribution equipment and materials (procurement only) • Spare parts and maintenance tools	489	—	489
Detailed Design and Work Supervision		49	87	136
Total		538	1,684	2,222

(2) Sierra Leonean Portion USS$165,600 (approx. ¥19.29 million)

The main cost items for the Sierra Leonean side are listed below.

① Removal of the existing foundations and a corridor and levelling of the land at Kingtom Power Station : US$19,000 (approx. ¥2.21 million)

② Levelling of the land, removal of obstacles and installing fences and a gate at Regent Substation site : US$22,500 (approx. ¥2.62 million)

③ Installation of 11kV/Low Voltage distribution equipment and materials : US$124,100 (approx. ¥14.45 million)

(3) Estimation Conditions

① Date of Estimation : September, 2006

② Foreign Exchange Rates : 1US$ = ¥116.45 (TTS average from March to August 2006)
1Euro = ¥146.14 (same as above)

③ Work Period : Improvement of Freetown Distribution Network will be completed in a single year. However, National Treasury Defrayment Scheme will be applied for the Extension of Kingtom Power Station over Japan's two fiscal years; see the implementation schedule for the detailed design, facility construction and equipment procurement/installation periods

④ Others : The Project will be implemented in accordance with the Guidelines for Japan's Grant Aid

2-5-2 Operation and Maintenance Cost

The NPA has allotted 4 to 5 % of the current expenses to a maintenance cost [Refer to Table 2-5-2-(1)]. Since a maintenance cost for the equipment to be provided under the Project is approximately 3% of the equipment cost, it is approximately ¥50 million annually. Although the maintenance cost in 2004 of the NPA was 31.6 billion SLL (approximately ¥120 million), it is assumed to be nearly 4.5 billion SLL which is 1.4 times of the present cost at the time of the completion of the Project. If the diesel engine generators to be provided under the Project are operated at around 80% of planned utilization factor (90%), the current income will increase at approximately ¥1 billion annually, so the NPA is judged to be able to bear the maintenance cost for the equipment to be provided under the Project.

Table 2-5-2-(1) Current Expenses of NPA

Unit：1,000 Leone

		2002	2003	2004
Current Expense		**50,677,433**	**62,963,046**	**63,862,245**
Operating Expenses		36,392,122	40,103,930	38,670,706
	Fuel Cost	21,336,517	23,770,497	21,739,166
	Payroll cost	6,001,600	7,423,173	7,610,214
	Maintenance Cost	2,277,148	2,292,679	3,163,262
	Indirect Expenses	3,383,885	3,062,739	2,285,321
	Depreciation	3,392,972	3,554,842	3,872,743
Non-Operating Expenses	Financial Expenses, etc	14,285,311	22,859,116	25,191,539

[Source] National Power Authority Financial Statements Year 2002-2004

[Remarks] 100 Leone＝About 3.90 Yen (As of September)

The NPA average power sales unit cost in 2005 was US ¢ 28 /kWh. Based on the said unit cost, an estimated operation balance of the generation system under the Project is shown in Table 2-5-2-(2). As

shown in the said table, on the assumption of 34% or more of an annual utilization ratio of the generating system to be provided under the Project, the operation balance will be plus. The Sierra Leonean side should carry out appropriate maintenance and keep a proper ratio of system utilization for self-operation of the power station.

Table 2-5-2-(2) Estimated Operation Balance of Power Generating System in the Project

Item			Unit	Annual Facility Utilization Rate (%)				
				33	34	35	50	90
I.Revenue								
1 Installed Capacity	①		[kW]	10,000	10,000	10,000	10,000	10,000
2 Annual Running Time	②		[hr]	2,891	2,978	3,066	4,380	7,884
3 Generated Energy	③		[kWh]	28,908,000	29,784,000	30,660,000	43,800,000	78,840,000
4 In-House Power Consumption	④	(③×0.05)	[kWh]	1,445,400	1,489,200	1,533,000	2,190,000	3,942,000
5 Transmission, Distribution and	⑤	(③×0.3)	[kWh]	8,672,400	8,935,200	9,198,000	13,140,000	23,652,000
6 Sale of Energy	⑥	(③-④-⑤)	[kWh]	18,790,200	19,359,600	19,929,000	28,470,000	51,246,000
7 Average Unit Sale of Energy	⑦		[US$/kWh]	0.28	0.28	0.28	0.28	0.28
Total Revenue	⑧	(⑥×⑦)	[US$]	5,261,256	5,420,688	5,580,120	7,971,600	14,348,880
II.Expenditure								
1 Fuel Cost	⑨	(③×(2)×(4))	[US$]	3,490,641	3,596,418	3,702,195	5,288,850	9,519,930
2 Lubricating Oil Cost	⑩	(③×(3)×(5))	[US$]	133,671	137,721	141,772	202,531	364,556
3 Payroll Cost	⑪	((6)×16×12)	[US$]	144,162	144,162	144,162	144,162	144,162
4 Maintenance Cost	⑫	(8)×0.03	[US$]	406,126	406,126	406,126	406,126	406,126
5 Indirect Expenses	⑬	((10)×10/49.2)	[US$]	317,792	317,792	317,792	317,792	317,792
6 Depreciation	⑭	(9)	[US$]	812,251	812,251	812,251	812,251	812,251
Total Expenditure	⑮		[US$]	5,304,642	5,414,470	5,524,298	7,171,712	11,564,817
III.Operating Income			[US$]	-43,386	6,218	55,822	799,888	2,784,063
			JPY	-5,127,832	734,909	6,597,651	94,538,769	329,048,417

Preconditions in Examination

(1) Average Unit Sale of Energy	0.28	US$/kWh	2005 Financial Statement of NPA
(2) Fuel Unit Price	0.552	US$/ℓ	NPA Data, Assumed to Utilize Heavy Oil (US$0.44/ℓ) and Diesel Oil (US$1.00/ℓ) at 4:1
(3) Lubricating Oil Unit Price	2.89	US$/ℓ	NPA Data
(4) Fuel Consumption	0.219	ℓ/ k Wh	210g/kWh, Fuel Ratio 0.96
(5) Lubricating Oil Consumption	0.0016	ℓ/ k Wh	
(6) Payroll Unit Cost	751	US$/month	16 persons
(7) Exchange Rate	118.19	¥/US$	2007 January
(8) Equipment Cost	1,600,000,000	¥/2 units	
	13,537,524	US$/2 units	
(9) Depreciation	812,251	US$/annual	15-year Fixed Installment, 10% Terminal Value
(10) Indirect Expenses	130,295	US$/month	Indirect expenses proportionally distributed (10/49.2MW)by installed capacity in the Project
(11) Transmission and Distribution Loss	30%		

2-6 Other Relevant Issues

The following items might have a direct influence on the smooth implementation of the requested Japanese assistance.

1) If removal of the existing generating unit foundations remaining in the proposed site for a new powerhouse and leveling site to be taken by the Sierra Leonean side is delayed, the time of starting construction in the Project will be late. Consequently, the Sierra Leonean side should promote the construction work on their side by formulating an appropriate budgetary step, a removal plan, personnel plan and a plan to purchase equipment and materials.

2) If land acquisition and leveling of the proposed site for the Regent Primary Substation to be taken by the Sierra Leonean side is delayed, the time of starting construction will be late. Consequently, the Sierra Leonean side should promote the construction work on their side by formulating an appropriate budgetary step, a removal plan, personnel plan and a plan to purchase equipment and materials in order to carry out the said construction work without delay.

3) If explanation related to the distribution system improvement construction to surrounding residents and acquisition of their consent is delayed, this will have an influence on the laying process of distribution lines and cables, etc., so the Sierra Leonean side should take the progress of related procedures into account.

4) If the construction work of equipment and materials for low voltage distribution lines is delayed, the prescribed functions of the Project cannot be displayed within a construction period. Accordingly, the Serra Leonean side should promote the construction work on their side by formulating an appropriate budgetary step, a removal plan, personnel plan and a plan to purchase equipment and materials in order to carry out the said work without delay and to be in time for the process of the Project by forming a construction team

5) The Sierra Leonean side should continuously take environmental conservation into account by formulating an environmental control plan for the power station to be constructed under the Project and obtaining an approval from the Environmental Division of the Ministry of Lands, Housing, Country Planning and the Environment.

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3
PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effects

The expected effects through the implementation of the Project are described as follows.

Current Situation & Problems	Remedial Measures under the Project (Requested Japanese Assistance)	Direct Effects & Degree of Improvement	Indirect Effects & Degree of Improvement
1. Although electric power is provided to governmental agencies and public facilities in a preferential manner due to overwhelmingly insufficient generation capacity & distribution capacity in Freetown and the outskirts, household consumers cannot receive a satisfactory power supply.	Two (2) units of 5 MW diesel engine generators will be installed at the Kingtom Power Station. The 33/11 kV distribution lines will be rehabilitated & improved in Freetown.	The supply capability at the target year (2012) will exceed 7.0 MW of a peak load through the implementation of the Project, so it is possible to secure the capability. The power distribution capacity will also increase through distribution lines connecting between primary substations are improved.	(i) Economic activities will be revitalized in Freetown through stable power supply. (ii) Stable power will be provided in Freetown and quality of electric power will be improved. Accordingly, public & welfare facilities such as administrative agencies, schools & hospitals will be operated in a stable manner.
2. Although 7 units of generators in total are installed in Freetown, periodical maintenance cannot be taken due to financial difficulty in the power sector & insufficient reserve of power supply, so breakdowns of the generating system frequently occur.	Two (2) units of 5 MW diesel engine generators will be installed at the Kingtom Power Station.	The supply capability at the target year (2012) will exceed 7.0 MW of peak load through the implementation of the Project, so it is possible to carry out periodical maintenance by stopping the generating system.	Power Blackouts resulting from accidental troubles in the generating system will be reduced.
3. Distribution power loss reaches over 40% in Freetown & the outskirts due to damaged and deteriorated distribution equipment.	The 33/11 kV distribution lines will be rehabilitated and improved in Freetown.	The distribution loss can be reduced up to approximately 30% through the implementation of the Project.	Since available electric energy will increase, the financial situation at the NPA will be improved.
4. Since power distribution to Freetown and the outskirts is available only in the center of the city, surrounding areas are still unelectrified.	Construction of Regent substation, construction of 33 kV distribution line from Wilberforce to Regent substations and procurement of distribution equipment and materials for the areas around Regent substation will be implemented.	Approximately 3,200 houses in Regent area, the suburb of Freetown, will be electrified.	(i) Electrification of unelectrified communities in Regent area will contribute to improve living standards and to activate economic activities in the area. (ii) Public and welfare facilities in Regent area will be operated in a stable manner.

3-2 Recommendations

3-2-1 Recommendations to be Taken by Recipient Country

The following tasks should be taken by the Sierra Leonean side in order for the effects of the Projects to be realized and be sustainable.

(1) Although the total generating output until 2014 will exceed the peak demand through the implementation of the Project, power sources to meet a growth of power demand after 2015 should be surely developed and the marginal supply capacity (reserve capability) should be ensured so as to stop the generating system for periodical maintenance.

(2) The NPA should secure profits necessary to run the power supply business by surely billing and collecting electric charges.

(3) By ensuring budget necessary for appropriate maintenance of the power generation, transmission and distribution systems and purchase of spare parts, in order to minimize the possibility of suspensions in service due to an emergency or repair work by any chance, it should be planned to constantly store emergency spare parts.

(4) By thoroughly controlling operation records such as fuel consumption and the quantity consumed of the auxiliary power, generating cost should be appropriately controlled. At the same time, depreciation cost of the fixed assets of the power generation, transmission and distribution systems including the equipment and materials to be provided under the Project should be certainly appropriated into expenses to save as funds for future equipment investment.

(5) In order to appropriately carry out periodical inspections for the systems to be provided under the Project, an operation plan on the existing and new generating systems should be formulated.

(6) The results of the OJT and the counterpart (C/P) training should be certainly conveyed to all operation and maintenance personnel. At the same time, it should be endeavor to create preventive maintenance skills and to maintain and improve operation and maintenance skills.

(7) By appropriately operating the sludge treatment system to be provided under the Project, the environmental pollution resulting from effluence of oil should be prevented.

(8) In order to maximize the Project's effects, power supply improvement projects through the assistance of other donors should also be certainly implemented.

3-2-2 Technical Cooperation and Coordination with Other Donors

Since the diesel engine generators owned by the NPA frequently breakdown and are often neglected without being repaired for a long period of time even after the breakdown, this becomes a major cause for insufficient supply capability. Although the NPA carry out ordinary operation management, it is

difficult to say that they understand preventive maintenance to check a serious accident of the equipment before it happens. In order for the generating system to be provided under the Project to continue stable operation for a long period of time and to usefully realize the effects, it is desirable to conduct technical cooperation (dispatch of long-term experts) for the purpose of transferring preventive maintenance of the diesel engine generators and preventive maintenance skills subject to operation and maintenance personnel at the Kingtom Power Station.

The World Bank supports the rehabilitation of the existing diesel engine generators at the Kingtom Power Station and the improvement in the 33 kV distribution network through the Power and Water Project (PWP). As the ensured power supply capability and an increase in distribution capacity can be accomplished through the implementation of the PWP, it is expected to realize the effects of the Project more usefully. Consequently, collaboration should be taken with the World Bank by exchanging information on the progress and scope of the assistance as much as is desired.

APPENDICES

1. MEMBER LIST OF THE STUDY TEAM

Member List of the Study Team

1. Basic Design Study

Name	Work Assignment	Position
Mr. Hiroyuki HAYASHI	Leader	Transportation and Electric Power Team, Project Management Group I, Grant Aid Management Department, JICA
Mr. Mitsuhisa NISHIKAWA	Chief Consultant/ Power Supply Planner	Yachiyo Engineering Co., Ltd.
Mr. Kyoji FUJII	Generation Equipment Planner (Diesel Engine Generator)	Yachiyo Engineering Co., Ltd.
Mr. Hirohito SETO	Distribution Lines Equipment Planner (Overhead & Underground Distribution Lines)	Yachiyo Engineering Co., Ltd.
Mr. Susumu IMAI	Building Planner / Natural Conditions Surveyor (Topographic, Geology)	Yachiyo Engineering Co., Ltd.
Mr. Takayuki MIYAMOTO	Construction and Procurement Planner / Cost Estimator	Yachiyo Engineering Co., Ltd.
Mr. Tomonori KONDO	Generation Equipment Planner (Electrical System)	Yachiyo Engineering Co., Ltd.

2. Draft Basic Design Study

Name	Work Assignment	Position
Mr. Masato Kumagai	Leader	Deputy Resident Representative, JICA Ghana Office
Mr. Mitsuhisa NISHIKAWA	Chief Consultant/ Power Supply Planner	Yachiyo Engineering Co., Ltd.
Mr. Kyoji FUJII	Generation Equipment Planner (Diesel Engine Generator)	Yachiyo Engineering Co., Ltd.

2. SURVEY SCHEDULE

Survey Schedule

1. Basic Design Study

No.	Date	Day of the week	Survey Contents		Stay at
			Official	Consultant Members (Yachiyo Engineering Co., Ltd.)	
			JICA (Mr. Hiroyuki Hayashi)	Mr. Mitsuhisa Nishikawa, Mr. Kyoji Fujii, Mr. Hirohito Seto, Mr. Susumu Imai, Mr. Takayuki Miyamoto and Mr. Tomonori Kondo	
1	19 Aug.	Sat		(Mr. Nishikawa, Mr. Seto, Mr. Fujii and Mr. Imai) *Trip from Tokyo (12:45) to Amsterdam (17:45)by JL-411	Amsterdam
2	20 Aug.	Sun		(Mr. Nishikawa, Mr. Seto, Mr. Fujii and Mr. Imai) *Trip from Amsterdam (09:10) to Brussels (10:00) by KL-1723 *Trip from Brussels (11:55) to Freetown (16:40) by SN-245	Freetown
3	21 Aug.	Mon.		• Courtesy call to JICA Sierra Leone Field Office and explanation/discussion of the schedule, contents, etc. of the field survey in Freetown. • Courtesy call to MEP & NPA and submission of Inception Report, explanation/discussion of the schedule, contents, of the field survey. • Negotiation with the Local Company for Topographic survey and Soil Investigation.	Freetown
4	22 Aug.	Tue.		• Discussions with MEP and NPA to confirm the background of a request made by Sierra Leone side and undertakings of Sierra Leone side, and field survey methods. • Visiting and surveying of Kingtom Power Station • Confirmation of Topographic survey and Soil Investigation points.	Freetown
5	23 Aug.	Wed.		• Field survey and data collection at Kingtom P/S and Congo Cross, Brookfield and Wilberforce S/S *Trip from Tokyo(12:45) to Amsterdam (17:45)by JL-411 (Mr. Kondo)	Freetown Mr. Kondo Amsterdam
at6	24 Aug.	Thu.		• Field survey and data collection at Falcon Bridge, Blackhole Road and Wellington S/S. • Negotiation with the Local Company for Topographic survey and Soil Investigation. *Trip from Amsterdam(09:10) to Brussels(10:00) by KL-1723 and Brussels(12:10) to Freetown(19:55) by SN-239 (Mr. Kondo)	Freetown
7	25 Aug.	Fri.		• Confirmation of the construction site of Regent S/S and the route of 33kV distribution line • Confirmation of the requested substations to be repaired	Freetown
8	26 Aug.	Sat.		• Internal meeting and sorting of collected data and information *Trip from Tokyo (12:45) to Amsterdam (17:45)by JL-411 (Mr. Miyamoto)	Freetown Mr. Miyamoto Amsterdam
9	27 Aug.	Sun	*Trip from Tokyo (12:45) to Amsterdam (17:45) by JL-411	• Internal meeting and sorting of collected data and information *Trip from Amsterdam (09:10) to Brussels (10:00) by KL-1723 and Brussels (11:55) to Freetown(16:40) by SN-245 (Mr. Miyamoto)	Official: Amsterdam Consultant : Freetown
10	28 Aug.	Mon.	*Trip from Amsterdam (07:00) to Brussels (07:55) by KL-1721 and Brussels (11:55) to Freetown (16:40) by SN-245	• Collection of Data and Information of Power Demand Forecast in Freetown • Field Survey at Kingtom P/S as follows; - Electrical system - Mechanical system • Negotiation with the local contractors	Freetown
11	29 Aug.	Tue.	(Mr.Hayashi, Mr. Nishikawa and Mr. Fujii) • Courtesy Call to JICA Sierra Leone Field Office • Courtesy Call to MODEP • Courtesy Call to MEP and NPA • Visit the World Bank's Sierra Leone Office and confirm the scope and progress status of "Power and Water Project" for power sector	(Mr. Seto, Mr. Miyamoto, Mr. Imai and Mr. Kondo) • Field Survey at Kingtom P/S • Field Survey at Substations and Distribution lines • Collection of data and information from local civil works • Collection of data and information from local construction company	Freetown
12	30 Aug.	Wed.	• Field survey on 33kV/11kV power distribution system (Including substations) • Field survey at Kingtom Power Station • Collecting data and Information related to facility		Freetown
13	31 Aug.	Thu.	• Field survey on 11kV underground cable route between Congo Cross S/S-Wilberforce S/S and Falconbridge S/S -Blackhall road S/S and substations • Submission and explanation of Minutes of Discussions (M/D)	(Mr. Seto, Mr. Miyamoto, Mr. Imai and Mr. Kondo • Field Survey at Kingtom P/S • Collection of data and information from local civil works • Collection of data and information from NPA	Freetown
14	1 Sep.	Fri.	• Explanation and discussion on M/D	• Collection of data and information from NPA	Freetown
15	2 Sep.	Sat.	• Internal meeting, data analysis and General survey		Freetown
16	3 Sep.	Sun	• Internal meeting and data analysis		Freetown

No.	Date	Day of the week	Survey Contents			Stay at
			Official	Consultant Members (Yachiyo Engineering Co., Ltd.)		
			JICA (Mr. Hiroyuki Hayashi)	Mr. Mitsuhisa Nishikawa, Mr. Kyoji Fujii, Mr. Hirohito Seto, Mr. Susumu Imai, Mr. Takayuki Miyamoto and Mr. Tomonori Kondo		
17	4 Sep.	Mon.	• Signing of M/D • Report to JICA Sierra Leone Field Office • Field Survey of Kingtom Power Station (Consultant members) *Trip from Freetown (15:10) to Accra (17:10) by B3-253	*Trip from Freetown (17:55) to Brussels (05:35+1) by SN-207 (Mr. Fujii)	(Mr. Seto, Mr. Miyamoto, Mr. Imai and Mr. Kondo) • Site survey at Kingtom P/S and Market survey • Field survey From Kingtom P/S to Congo Cross S/S • Collection of Data and Preparation of basic design	Freetown
18	5 Sep	Tue.	• Report to EOJ and JICA Ghana office *Trip from Accra (21:10) to Amsterdam (06:00+1) by KL-590	• Collection of data and topographic survey at Kingtom P/S • Collection of data and information for distribution • Data analysis for P/S and Distribution system *Trip from Brussels (07:55) to Amsterdam (08:55) by KL1728、from Amsterdam (20:15) to Tokyo (14:30+1) by JL-412 (Mr. Fujii)		Official: On board Consultant: Freetown Mr. Fujii on board
19	6 Sep	Wed.	*Trip from Amsterdam (20:15) to Tokyo (14:30+1) by JL-412}	• Field survey at Kingtom P/S on operation and maintenance status • Soil investigation and topographic survey • Meeting with NPA and confirmation of land owner for Regent S/S • Collection of data at Roads Authority, road Map and NPA *Arrive at Tokyo (14:30) (Mr. Fujii)		Official: On board Consultant: Freetown Mr. Fujii On board
20	7 Sep.	Thu.	*Arrive at Tokyo (14:30) by JL-412	• Field survey at Kingtom P/S on operation and maintenance status • Soil investigation and topographic survey • Detailed survey on 11kV line between Wilberforce, Regent S/S and Water reservoir station		Freetown
21	8 Sep.	Fri.		• Visit Bumbuna Project Office and interview on the progress status of the project • Field survey on transportation infrastructure (Port and roads) • Field survey of. Eastern Police, Africanus Road, Riverside Drive, Spur Road and Lumley Village S/S		Freetown
22	9 Sep.	Sat.		• Internal meeting and data analysis • Preparation of Field Report (FR)		Freetown
23	10 Sep.	Sun		• Preparation of FR • Internal Meeting		Freetown
24	11 Sep.	Mon.		• Submission of draft of FR to NPA • Confirmation of the location of Regent S/S with Ministry of Lands, Country Planning Forestry and the Environment, and Social Welfare (MLCFES) and NPA • Collection of data and information • Analysis of Soil investigation and topographic survey data		Freetown
25	12 Sep.	Tue.		• Explanation and discussion on FR with NPA • Collection of data and information		Freetown
26	13 Sep.	Wed.		• Collection and discussion of FR • Collection of data and information		Freetown
27	14 Sep.	Thu.		• Explanation and discussion on FR • Collection of data and information *Trip from Freetown (21:00) to Brussels (05:20+1) by SN-239 (Mr. Seto)		Mr. Seto: On board Others: Freetown
28	15 Sep.	Fri.		• Obtain approval for Field Report from MEP and NPA • Collection of data and information *Trip from Brussels (07:55) to Amsterdam (08:55) by KL-1728 *Trip from Amsterdam (20:15) to Tokyo (14:30+1) by JL-412 (Mr. Seto)		Mr. Seto: On board Others: Freetown
29	16 Sep.	Sat.		• Correction of Field Report • Internal meeting • Arrive at Tokyo (14:30) by Jl-412 (Mr. Seto)		Freetown
30	17 Sep.	Sun		• Correction of Field Report • Internal meeting		Freetown
31	18 Sep.	Mon.		• Collection of data and information • Report to JICA Sierra Leone Field Office		Freetown
32	19 Sep.	Tue.		• Collection of data and information *Trip from Freetown (18:10) to Accra (20:30) by KQ-511 (Mr. Nishikawa, Mr. Imai, Mr. Miyamoto and Mr. Kondo)		Accra

No.	Date	Day of the week	Survey Contents		Stay at
			Official	Consultant Members (Yachiyo Engineering Co., Ltd.)	
			JICA (Mr. Hiroyuki Hayashi)	Mr. Mitsuhisa Nishikawa, Mr. Kyoji Fujii, Mr. Hirohito Seto, Mr. Susumu Imai, Mr. Takayuki Miyamoto and Mr. Tomonori Kondo	
33	20 Sep.	Wed.		• Report to EOJ and JICA Ghana Office *Trip from Accra (21:10) to Amsterdam (06:00+1) by KL-590 (Mr. Nishikawa, Mr. Imai, Mr. Miyamoto and Mr. Kondo)	On board
34	21 Sep.	Thu.		*Arrive at Amsterdam (06:00) by KL-590 *Trip from Amsterdam (20:15) to Tokyo (14:30+1) by JL-412 (Mr. Nishikawa, Mr. Imai, Mr. Miyamoto and Mr. Kondo)	On board
35	22 Sep.	Fri.		*Arrive at Tokyo (14:30) by JL-412 (Mr. Nishikawa, Mr. Imai, Mr. Miyamoto and Mr. Kondo)	

[Remarks]

EOJ: Embassy of Japan

JICA: Japan International Cooperation Agency

MODEP: Ministry of Development and Economic Planning

MEP: Ministry of Energy and Power

NPA: National Power Authority

M/D: Minutes of Discussions

P/S: Power Station

S/S: Substation

FR: Field Report

2. Draft Basic Design Study

No.	Date	Day of the week	Survey Contents		Stay at
			Official	Consultant Members (Yachiyo Engineering Co., Ltd.)	
			JICA (Mr. Masato Kumagai)	Mr. Mitsuhisa Nishikawa and Mr. Kyoji Fujii	
1	23 Feb.	Fri	Trip ACC to FNA by Air		
2	24 Feb.	Sat		*Trip from Tokyo (13:30) to Amsterdam (17:35)by JL-411	Amsterdam
3	25 Feb.	Sun		*Trip from Amsterdam (09:20) to Brussels (10:10) by KL-1723 *Trip from Brussels (12:20) to Freetown (18:05) by SN-245	Freetown
4	26 Feb.	Mon.		• Courtesy call to JICA Sierra Leone Field Office and explanation/discussion of Draft Basic Design Report. • Courtesy call to MEP & NPA and submission/explanation/discussion of Draft Basic Design Report. • Site survey at Kingtom P/S, Wilberforce S/S and Regent S/S site.	Freetown
5	27 Feb.	Tue.		• Discussions on Draft Basic Design Report with MEP and NPA • Meeting with the World Bank • Courtesy call to Hon. Consulate General of Japan	Freetown
6	28 Feb.	Wed.		• Discussions on the M/D • Courtesy call to MODEP	Freetown
7	1 Mar.	Thu.		• Survey on construction materials • Signing of M/D	Freetown
8	2 Mar.	Fri.		• Report to JICA Sierra Leone Field Office *Trip from Freetown (18:10) to Accra (20:30) by KQ-511	Accra
9	3 Mar.	Sat.		• Internal meeting and sorting of collected data and information	Accra
10	4 Mar.	Sun		• Internal meeting and sorting of collected data and information	Accra
11	5 Mar.	Mon.		• Report to JICA Ghana Office *Trip from Accra (22:15) to Amsterdam (06:00+1) by KL-590	On board
12	6 Mar.	Tue.		*Arrive at Amsterdam (06:00) by KL-590 *Trip from Amsterdam (20:15) to Tokyo (15:50+1) by JL-412	On board
13	7 Mar.	Wed.		*Arrive at Tokyo (15:50) byJL-412	

[Remarks]

EOJ: Embassy of Japan

JICA: Japan International Cooperation Agency

MODEP: Ministry of Development and Economic Planning

MEP: Ministry of Energy and Power

NPA: National Power Authority

M/D: Minutes of Discussions

P/S: Power Station

S/S: Substation

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

3. List of Parties Concerned in the Recipient Country

Name and Organization	Position
The Government of Sierra Leone	
Alhaji Dr. Ahmad Tejan Kabbah	President
Ministry of Development and Economic Planning: MODEP	
Mr. Ibrahim Mohamed Sesay	Deputy Minister
Ms. Konah C. Koroma	Development secretary
Ministry of Energy and Power: MEP	
Mr. Lloyd Ado During	Minister
Mr. Francis Bockarie	Permanent Secretary
Dr. Shem-Gbay Swaray	Director, National Energy and Water Policy, Planning and Coordination Unit
Mr. Michael A. Conteh	Program Officer, Power
National Power Authority: NPA	
Alhaji Ing. Foday Mannah	General Manager
Mr. Mahmood B. G. Timbo	Former Acting General Manager Technical Director / Engineering Head (Incumbent)
Mr. Patrick Tarawalli	Deputy General Manager
Mr. Denis J. S. Garvie	Former Acting Deputy General Manager
Mr. Abdul P. Y. Kamara	System Planning Manager
Mr. Emmanuel Caram	Internal Auditor
Mr. Cecil French	Senior Planning Engineer
Mr. Hassan Barrie	Generation Manager, Kingtom Power Station
Mr. Rolf Achmus	Generation Manager, Kingtom Power Station
Mr. John Dumbuya	Senior Electrical Engineer, Kingtom Power Station
Mr. Solomon Gbassay Musa	Mechanical Engineer, Kingtom Power Station
Mr. Yembeh Michael A. Mansaray	T & D Manager, Western Area
Mr. A. Timbo	Electrical Engineer
Mr. John Yamsie Taylor	Drawing Officer
Ministry of Land, Country Planning and Environment	
Mr. Alfred Robson Sebay	Minister
Mr. Syril Jusu	Director of Environment
Mr. Daniel Allie	Assistant Town Planning officer
Sierra Leone Roads Authority	
Mr. El-Hadj I.M. Kebbay	Director-General
Mr. John M. Swaray	Chief Engineer & Head ,RIMPU
Mr. Peter Sone Kome	Engineer RIMPU
Sierra Leone Ports Authority	
Mr. Nestor P. Gallry	General Manager
Mr. Morray Mix-Sayed Jusu	Public Relations Officer
Meteorological Department	
Mr. Denis Pombi Lansana	Director
Embassy of Japan in Ghana	
Mr. Yutaka Nakamura	Counselor, Deputy Head of Mission
Mr. Ken Sakaguchi	Secretary

JICA Sierra Leone Field Office

Dr. Katsuya Kuge	Resident Officer
Ms. Megumi Kaneda	Project Formulation Advisor
Mr. Akio Odake	Advisor for Development Planning
Ms. Naoko Imoto	Programme Officer

JICA Ghana Office

Mr. Hiroshi Murakami	Resident Representative
Mr. Masato Kumagai	Deputy Resident Representative
Mr. Masakatsu Okumoto	Staff

4. MINUTES OF DISCUSSIONS

Minutes of Discussions
on the Basic Design Study on the Project for
Urgent Improvement of Electric Power Supply System in Freetown
in the Republic of Sierra Leone

In response to the request from the Government of the Republic of Sierra Leone (hereinafter referred to as "Sierra Leone"), the Government of Japan decided to conduct the Basic Design Study on the project for Urgent Improvement of Electric Power Supply System in Freetown (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Sierra Leone the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Hayashi Hiroyuki, Senior Program Administration Officer of the Transportation and Electric Power Team of the Project Management Group I, the Grant Aid Management Department, JICA, and is scheduled to stay in the country from August 20 to September 19, 2006.

The Team held discussions with the officials concerned of the Government of Sierra Leone and conducted a field survey at the study area.

As a result of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Freetown, September 4, 2006

Mr. Hayashi Hiroyuki
Leader
Basic Design Study Team
Japan International Cooperation Agency

Mr. Mahmood B.G. Timbo
Acting General Manager
National Power Authority (NPA)
Republic of Sierra Leone

H. E. Lloyd A. During
Minister
Ministry of Energy and Power (MEP)
Republic of Sierra Leone

Ms. Konah C. Koroma
Development Secretary
Ministry of Development & Economic Planning (MODEP)
Republic of Sierra Leone

ATTACHMENT

1. Objective of the Project

The objective of the Project is to rehabilitate and extend electric power supply system in Freetown, Western Area.

2. Project Site

The Project sites are Kingtom Power Station for Diesel Engine Generator (DEG) and associated ancillaries, and Western Area for Distribution Lines (D/L).

3. Responsible and Implementing Organizations

(1) The Responsible Ministry is the Ministry of Energy and Power (MEP).
(2) The Implementing Agency is the National Power Authority (NPA).
(3) The organization chart of NPA is shown in Annex-1.

4. Items Requested by the Sierra Leonean Side

After discussions with the Team, the following components were finally requested by the Sierra Leonean side. JICA will assess the appropriateness of the request, scrutinize each component and will recommend to the Government of Japan for approval.

(1) Construction of 2 sets of 5 MW DEG and associated ancillaries including an oil-water separator, incinerator, etc.
(2) Construction of a Powerhouse to accommodate DEGs and necessary ancillaries.
(3) Construction of the following 33 / 11 kV distribution systems.
   1) A 33 kV D/L from Wilberforce Primary Substation to Regent Primary Substation in Western Area as per Annex-2 including a 33kV feeder panel to be installed at Wilberforce Primary Substation.
   2) Regent Primary Substation including a 33 /11 kV, 5 MVA transformer and a substation house.
   3) An 11 kV D/L from Kingtom Power Station to Congo Cross Primary Substation including a 11 kV feeder panel to be installed at Kingtom Power Station.
   4) An 11 kV D/L from Congo Cross Primary Substation to Wilberforce Primary Substation.
(4) Procurement of the following 11kV distribution Equipment and Materials with necessary accessories.
   1) From Falcon Bridge Primary Substation to Blackhall Road Primary Substation.
   2) From Regent Primary Substation to Guma water reservoir including compact substation(s) and 11k V/400 V step-down transformer(s).
   3) Five (5) sets of five (5) way SF6 type 250 MVA switchboards (Ring Main Units) for Eastern Police, Africanus Road, Riverside Drive, Spur Road and Lumley Village Substations.
(5) Procurement of Maintenance tools and spare parts for DEGs and 33/11 kV distribution systems.
(6) Conducting of "On the Job Training (OJT)" for the operation and maintenance techniques by the Equipment supplier(s) during installation period.

5. Japan's Grant Aid Scheme

(1) The Sierra Leonean side understands the Japan's Grant Aid Scheme explained by the Team as described in Annex-3.

(2) The Sierra Leonean side will take the necessary measures, as described in Annex-4, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the Study

(1) The Team will proceed to further studies in Sierra Leone until September 19, 2006.

(2) JICA will prepare the draft report in English and dispatch a team to Sierra Leone in order to explain its contents around the middle of February 2007.

(3) When the contents of the draft report are accepted in principle by the Government of Sierra Leone, JICA will complete the final report and send it to the Government of Sierra Leone around the end of March 2007.

7. Other Relevant Issues

(1) The Team explained to the Sierra Leonean side that distribution systems beyond secondary terminal of distribution transformers including pre-paid maters should be excluded from the Project as the results of Preliminary Study of the Project.

(2) The Sierra Leonean side agreed to secure, clear, level and reclaim the land for Regent Primary Substation and a copy of land acquisition certificate shall be handed to the Japanese side (through the JICA Sierra Leone Field Office) on or before the end of March 2007.

(3) The Sierra Leonean side agreed to clear, level and reclaim the land for new DEG construction at Kingtom Power station including demolishing existing foundations prior to the commencement of the Project.

(4) The Team explained to the Sierra Leonean side that if the following conditions are not satisfied before the end of March 2007, the Construction Works of Regent Substation and 33 kV D/L between Wilberforce and Regent Substations might be excluded from the Project.

1) Item (2) stated above is completely fulfilled.
2) It is recognized that the construction of 33 kV D/L under the Power and Water Project (PWP) financed by the World Bank will be certainly completed prior to the commencement of the distribution components of the Project.

(5) The Sierra Leonean side agreed to follow necessary environmental procedure(s) prescribed in the Environment Protection Act of Sierra Leone and to obtain necessary approval(s) from the Environment Division, the Ministry of Lands, Country Planning and Environment by the end of March 2007.

(6) The Sierra Leonean side requested to include the construction of the oil water separator and the incinerator into the Project in order to meet the requirement stipulated in the environmental standards and regulations.

(7) The Sierra Leonean side agreed to obtain the following permissions prior to the commencement of the Project.

1) Permission(s) necessary to cut trees, which may obstacle, the 33 kV D/L between the Wilberforce Substation and Regent Substation, from the Ministry of Lands, Country Planning and Environment.
2) Permission(s) necessary to install electric poles from land owner(s), in case electric poles are to be installed in the private land(s).
3) Permission(s) necessary for enforcement of traffic controls during the installation and/or rehabilitation of 33/11 kV D/L from Sierra Leone Road Authority and Sierra Leone Police Office prior to the commencement of the Project.

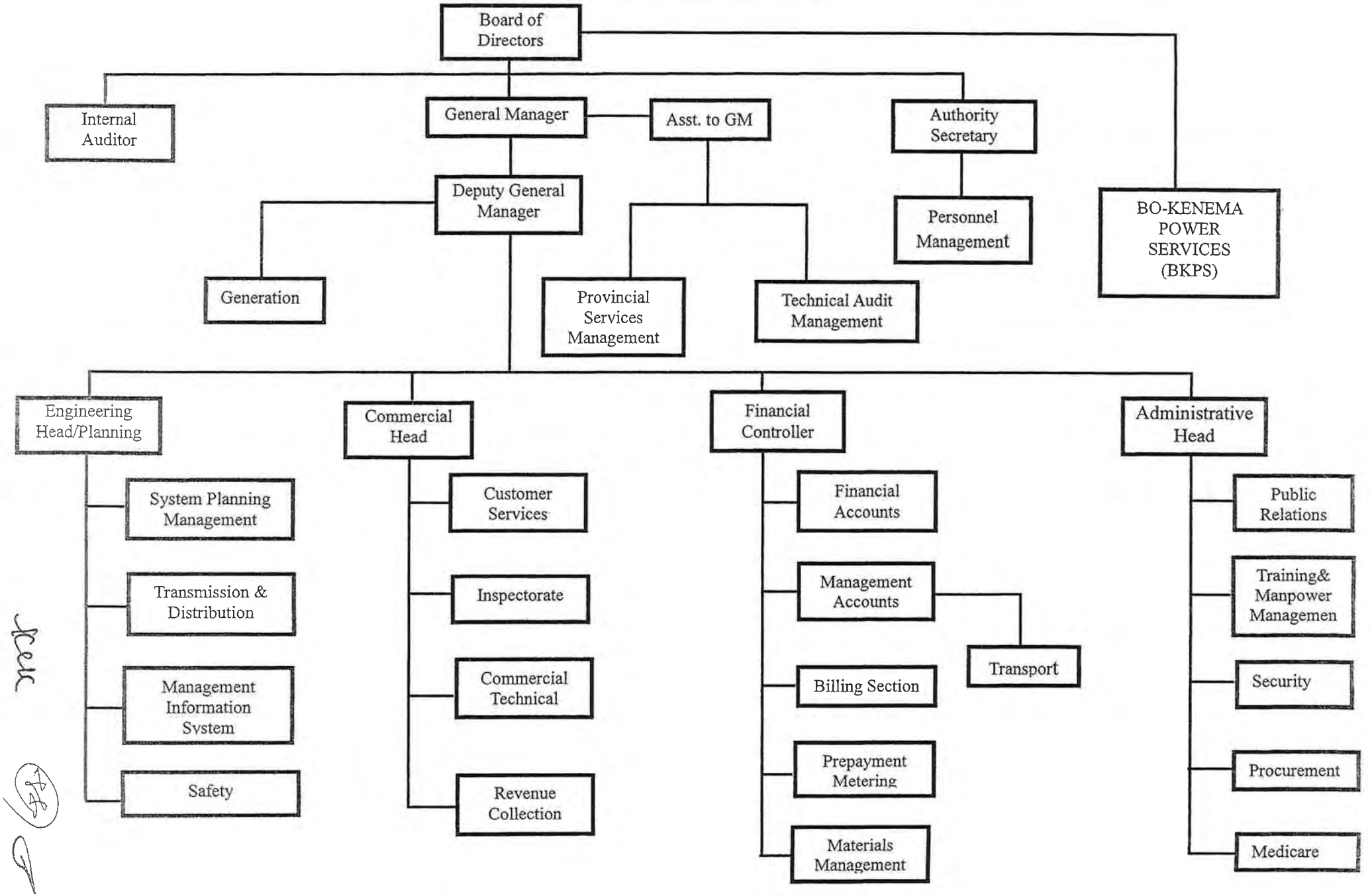
(8) The Sierra Leonean side requested to include the internal transportation of the equipment and materials for the Project from the port of disembarkation to the project sites into the Project.

(9) The Sierra Leonean side shall provide necessary number(s) of counterpart personnel to the Team during the period of the studies in Sierra Leone.

(10) The Sierra Leonean side should complete answers to the Questionnaire in English, which the Team handed to the Sierra Leonean side, by September 10th, 2006.

(11) The Sierra Leonean side requested the Team to carry out the counterpart training to NPA staff(s) in Japan on operation and maintenance techniques of new facilities as technical cooperation by JICA. The Sierra Leonean side understood that it is requested to submit the official request regarding the above-mentioned training with concrete contents of training through the JICA Sierra Leone Field Office by the end of June 2007.

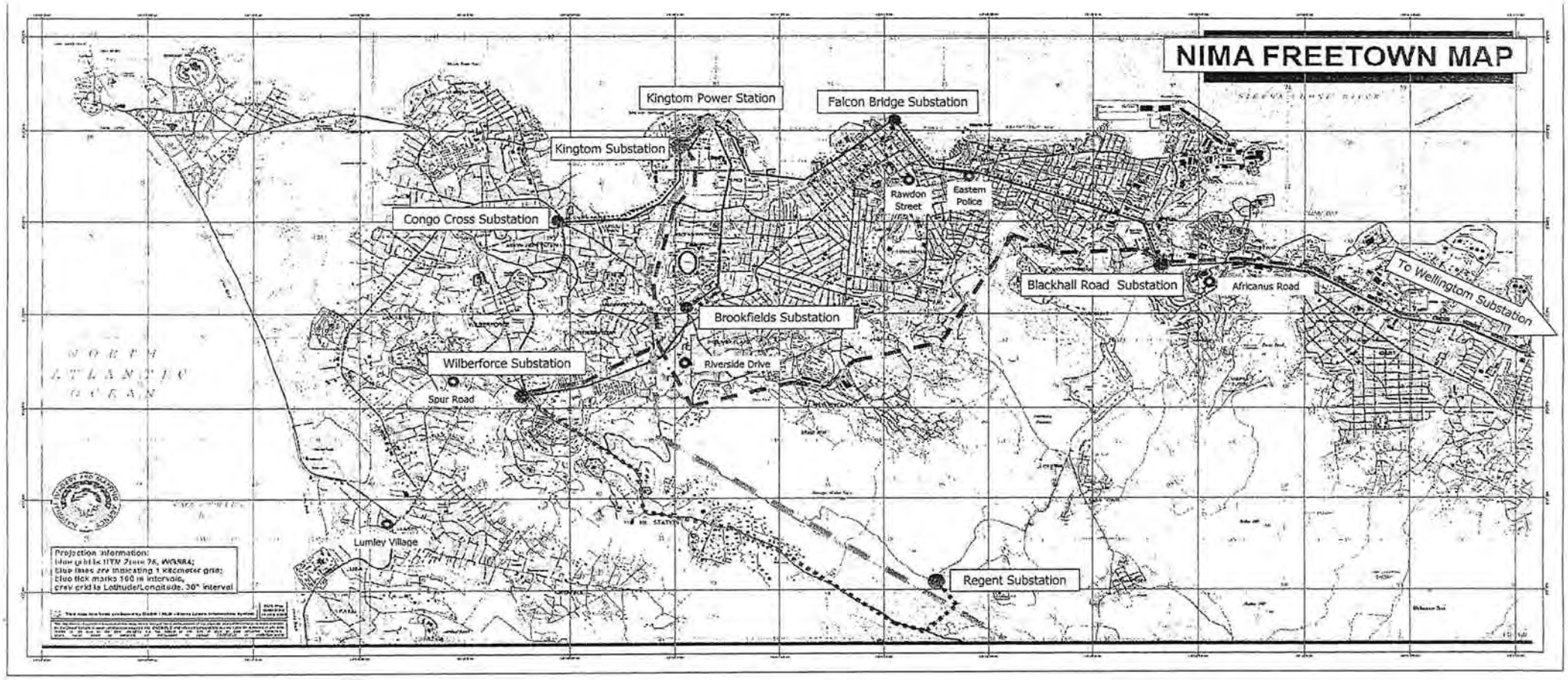
NATIONAL POWER AUTHORITY
ORGANISATIONAL CHART



A-4-5

Annex-1

Project Area



[Remarks]

- Kingtom Power Station (Scope of the Project)
- 11 kV Primary Substation
- 11 kV Secondary Substation (Scope of the Project (Equipment Eupply only))
- 33 kV Substation (Under Construction)
- 33 kV Substation (to be upgraded under the World Bank Project)
- 33 kV Substation (Scope of the Project)

- 11 kV Distribution Line (Existing)
- 11 kV Distribution Line (Scope of the Project)
- 11 kV Distribution Line (Scope of the Project (Equipment and Materials Supply only))
- 33 kV Sub-transmission Line (Existing)
- 33 kV Sub-transmission Line (to be constructed under the World Bank Project)
- 33 kV Sub-transmission Line (Scope of the Project)
- 161 kV Sub-transmission Line (Plan)

Scale 0 0.5 1km

Source of the Map: http://www.daco-sl.org/encyclopedia/2_data/2_3b3_t.htm

Japan's Grant Aid Scheme

The Grant Aid scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid scheme is executed through the following procedures.

Application:	(Request made by a recipient country)
Study:	(Basic Design Study conducted by JICA)
Appraisal & Approval:	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation:	(The Notes exchanged between the Governments of Japan and the recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request. If the request is required further information, a Preparatory study would be conducted by JICA.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the smooth implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid scheme from a technical, social and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project
- Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure 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 organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry (ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consulting firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as natural disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

4) Necessity of "Verification"
The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

5) Undertakings required of the Government of the Recipient Country
In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites

c) To secure buildings prior to the procurement in case the installation of the equipment.

d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

6) "Proper Use"

The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay (A/P) issued by the Government of the recipient country or its designated authority.

9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and Payment commissions to the Bank.

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1.	To secure land		●
2.	To clear, level and reclaim the site when needed		●
3.	To construct gates and fences in and around the site		●
4.	To construct the parking lot	●	
5.	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
6.	To construct the buildings	●	
7.	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others) to the site		●
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4) Gas Supply		
	a. The city gas main to the site	N/A	N/A
	b. The gas supply system within the site	N/A	N/A
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
8.	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
9.	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	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	●	
10.	To accord Japanese nationals, whose services may be required in connection with the supply of the products and the services under the verified contact, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
11.	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
12.	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant.		●
13.	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment.		●

B/A : Banking Arrangement, A/P : Authorization to Pay

Minutes of Discussions
on the Basic Design Study on the Project for
Urgent Improvement of Electric Power Supply System in Freetown
in the Republic of Sierra Leone
(Explanation on the Draft Report)

In August to September 2006, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Urgent Improvement of Electric Power Supply System in Freetown (hereinafter referred to as "the Project") to Sierra Leone, and through discussions, field survey and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult with the concerned officials of the Government of Sierra Leone on the contents of the draft report, JICA sent to Sierra Leone the Basic Design Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Kumagai Masato, Deputy Resident Representative of JICA Ghana Office from February 25 to March 2, 2007.

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

Freetown, March 1, 2007

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Basic Design Study Team
Japan International Cooperation Agency

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Republic of Sierra Leone

H. E. Lloyd A. During
Minister
Ministry of Energy and Power (MEP)
Republic of Sierra Leone

Ms. Konah C. Koroma
Development Secretary
Ministry of Development & Economic Planning
(MODEP)
Republic of Sierra Leone

ATTACHMENT

1. Contents of the Draft Report

The Sierra Leonean side agreed and accepted in principle the contents of the Draft Report explained by the Team.

2. Japan's Grant Aid Scheme

The Sierra Leonean side reconfirmed the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Sierra Leone explained by the Team as described in Annex-3 and Annex-4 of the Minutes of Discussions (M/D) signed by both sides on September 4, 2006.

3. Schedule of the Study

JICA will complete the Final Report in accordance with the confirmed items and send it to the Sierra Leonean side around April 2007.

4. Other Relevant Issues

(1) The Sierra Leonean side agreed to secure, clear, level and reclaim the land for Regent Primary Substation and a copy of land acquisition certificate shall be handed to the Japanese side (through the JICA Sierra Leone Field Office) on or before the end of April 2007.

(2) The Sierra Leonean side should allocate the budget for distribution systems beyond secondary terminal of distribution transformers including pre-paid meters and implement the house wiring works within 2 years after completion of the distribution lines covered by the Japan's Grant Aid.

(3) The Sierra Leonean side should allocate the budget for clearing, leveling and reclaiming the land for new DEG construction at Kingtom Power station including demolishing existing foundations prior to the commencement of the Project by the end of December 2007.

(4) The Sierra Leonean side should follow necessary environmental procedure(s) prescribed in the Environment Protection Act of Sierra Leone and to obtain necessary approval(s) from the Environment Division, the Ministry of Lands, Country Planning and Environment by the end of April 2007.

(5) The Sierra Leonean side should take necessary measures for obtaining the following permissions prior to the commencement of the Project.

1) Permission(s) necessary to cut trees, which may obstruct, the 33 kV D/L between the Wilberforce Substation and Regent Substation, from the Ministry of Lands, Country Planning and Environment by the end of December 2007.
2) Permission(s) necessary to install electric poles from land owner(s), in case electric poles are to be installed in the private land(s) by the end of December 2007.
3) Permission(s) necessary for enforcement of traffic controls during the installation and/or rehabilitation of 33/11 kV D/L from Sierra Leone Road Authority and Sierra Leone Police

Office prior to the commencement of the Project by the end of December 2007.

(6) The Team explained to the Sierra Leonean side that the Government of Japan is planning to implement the Project in two phases as follows.

1) Phase-1: Improvement of Freetown Distribution Network
2) Phase-2: Extension of Kingtom Power Station

(7) Both sides agreed that this draft design handed to Sierra Leonean side from the Team is confidential and should not be duplicated or released to any outside parties including the equipment specifications.

(8) The Sierra Leonean side understood that Duty Free processing service (Administrative fee) for Non-Tax Revenue (1.25 % of CIF value) and Foreign Travel Tax for the persons concerned with the Project during implementation stage will be borne by the Government of Sierra Leone.

5. BASIC DESIGN DRAWINGS