APPENDIX 5 FIELD REPORT

THE BASIC DESIGN STUDY
ON
THE PROJECT FOR
THE REINFORCEMENT OF ELECTRIC POWER DISTRIBUTION NETWORK
IN
KAMPALA
IN
THE REPUBLIC OF UGANDA

FIELD REPORT

February 26, 1991

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

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1. Introduction

This field report has been prepared by the basic design study team (hereinafter referred to as "the team") for the Project for Rehabilitation of Electric Power Distribution Network in Kampala in The Republic of Uganda (hereinafter referred to as "the Project"), based on the field survey and discussions with the authorities concerned of the Government of Uganda, in accordance with the Inception Report prepared by the team, in order to build mutual understanding of the Project.

This report describes the information obtained during the field survey, as well as the basic concept of the Project including an outline of main equipment for the Queensway substation and the Motor Mart switching station.

However all the items in the basic concept are subject to the approval of the Japanese Government.

In addition to the above, this report describes some undertakings to be carried out by the Government of Uganda if Grant Aid is extended.

As described in the Inception Report, the team will continue the study in Japan in accordance with this Field Report, data and information corrected during the field survey, as well as the discussions with authorities concerned of Japanese Government.

A final draft report of the Project will be prepared in consultation with the Japanese authorities concerned, and will be submitted by the beginning of May, 1991 as mentioned in the Minutes of Discussions.

2. Background of the Project

2.1 Power supply situation in Kampala city

2.1.1 Power demand in Kampala city

The present load demand in Kampala city is given in the Design Report of "Rehabilitation of 132/33/11KV Electricity Network in Kampala" prepared by Lahmeyer International on November 1989 (hereinafter referred to as "the Design Report 1989"), which has been approved by Uganda Electricity Board (UEB) and has been presented to the team by UEB for the purpose of conducting the basic design study.

According to the Design Report 1989, the actual load demand in Kampala in 1988 was 75.2MVA. This report also indicate the forecast power demand based on the actual data in 1988, that is 80.9MVA in 1990 and 140MVA in the year 2000.

Table-1 shows the load demand forecast in Kampala by the report.

Table-1 Load Demand Assignment to the Substations' 11KV Busbars
(Load Demand Forecast in Kampala City)

Substation		Maximum load demand (MVA) 1988	1990	1995	2000
Kampala North	(KNS)	25.5	29.0	33.5	44.3
Lugogo	(LGS)	27.5	28.0	31.4	40.1
Mutundwe	(MTS)	-	-	13.9	17.8
Queensway	(QWS)	22.2	23.9	16.4	20.9
Gaba II	(GBS)	-	-	6.8	7.2
Kireka	(KRS)	-	-	3.2	4.1
Port Bell	(PBS)	-	-	4.5	5.6
Total		75.2	80.9	109.7	140.0

Note : This table assumes completion or rehabilitation of LGS, MTS, GBS, KRS and PBS by 1995 under the second power project.

This corresponds to an increase of 5.3% p.a. over a period of 12 years.

2.1.2 Power supply system in Kampala city

The existing transmission and distribution system for the Kampala district can be classified in the following five voltage levels:

(1) 132KV transmission line from Owen Falls hydroelectric power station to Kampala North substation.

(2) 66KV transmission line from Owen Falls power station to Lugogo substation.

(3) 33KV distribution system to the city and its suburbs.

(4) 11KV distribution system to the city.

(5) 415V distribution system to the city.

Power has been supplied only from the Owen Falls hydroelectric power station which is the main power station in Uganda.

2.1.3 11KV distribution system

In order to supply power to the existing 11KV distribution system in Kampala, there are three major substations, i.e., Kampala North (KNS) and Lugogo (LGS) substations which are located in suburbs of the city, and Queensway substation (QWS) located in the center of the city.

In addition to the above three substations, several switching stations are located near the substations to distribute the 11KV power to the city.

Motor Mart switching station (MMS), a site of proposed works for the Project, is also located close by QWS. The distance between the stations is about 1.0km.

The capacity and/or size of the 11KV distribution system in Kampala district at present is given in Table-2.

Table-2 Description of Existing 11KV Distribution System in Kampala

	Descriptions	Installed Q'ty (approx.)	Basis
1.	Total length of 11KV Line		Design Report
	- Overhead	130 Km	1989
	- Underground	40 Km	
2.	Total No. of distribution transformers	650 sets	Ditto
3.	Total No. of poles	4500 sets	UEB

2.2 Related projects under planning and/or on-going

2.2.1 General

Based on the strategy of national development and/or rehabilitation plans, UEB formulated various projects under cooperation and financing by several agencies.

In 1984, in particular, UEB identified the needs for rehabilitation of the existing electricity system through several appraisal missions and studies.

In 1985, the Second Power Project, financed by the World Bank, CDC and ODA with about US$ 83.9 million was planned and is still being implemented in order to relieve immediate electrical energy constraints and to allow economic recovery in the medium term, including rehabilitation of the transmission and distribution network systems, etc.

However, in 1989, UEB was forced to consider prioritization of the planned project in the second power project because a shortfall in the financing due to price escalation, variation in exchange rates, etc., was identified.

Therefore UEB recently has planned the Third Power Project financed by the World Bank and other donors with about US$ 260 million, in order to follow-up the second power project.

The third power project also focuses on exploitation of hydroelectric power potential and on strengthening/extending the country's transmission and distribution facilities, in order to meet medium and long term demand necessary for economic growth, and to provide a framework for export growth.

Positioning of Japan's Grant Aid Project

This Grant Aid Project is positioned in a part of the third power project and will support the plan of rehabilitation of Kampala transmission and distribution network which is urgently required for economic recovery in the medium term.

2.2.2 Related project

33KV transmission line

As described in the aforesaid section 2.2.1, the Project is part of the plan for rehabilitation of the transmission and distribution network.

In the rehabilitation plan, the overall projected network configuration has been studied in the Design Report 1989.

However regarding the connection of 33KV line to Queensway substation (QWS), recently UEB has modified the network composition following further study of the system configuration to make it more reliable system.
The plan is given in Drawing No.1 "132/33/11KV network configuration related to the Project".

Consequently the following modifications have been made to the plan of the 33KV transmission line. The modification plan differs from the Design Report 1989 in the following respects:

(1) The existing 33KV Kampala South substation (KSS) will not be utilized after 1993 because of the end of serviceable life of all equipment in the substation.

(2) The existing 33KV transmission lines from KSS to Masaka and to Entebbe substation will be fed from Mutundwe substation (MTS).

(3) The existing 33KV lines from KSS to QWS will be transferred to MTS.

(4) The existing 33KV transmission line from Lugogo substation (LGS) to KSS will be diverted to QWS in order to make the system operation more reliable.

(5) A portion of the existing 33KV line from Kampala North substation (KNS) to KSS will be disconnected. The remaining portion will be re-utilized for the new 132KV Line from KNS to MTS.

For the implementation of the Project, item (3) & (4) of the said modification works will be directly concerned with the Project.

Table-3 shows the list of works directly related to the Project.

According to UEB, the load flow of the 33KV busbar line in the Design Report 1989 will be revised accordingly, but the design concept and basic design figures such as capacity of bus bar, interrupting capacity of circuit breakers, load assignment on 11KV busbar, etc., which were given to the team for the Project design will not be changed.

Table-3 33KV Transmission Plan concerned to the Project

Name of Project	Proposed financier	Planned Completion Date
1.33KV line connection from MTS to QWS (2 lines, about 4km/each line)	World Bank (See Note)	1993
2.33KV line connection from LGS to QWS (1 line, about 3km)	UEB	1993

Note: This new connection work of 33KV line from MTS to QWS is not included in current project (Contract No.302). Therefore UEB is planning to amend the contract so as to incorporate this work in the Contract 302.

SCADA system

To solve serious problem on the existing metering system and control of the systems, UEB has a plan to introduce a SCADA system in the transmission and distribution system, financed by Scandinavian countries in 1990. This project has commenced.

QWS is included in the SCADA system too.

3. Present situation of Project Sites

3.1 Queensway substation (QWS)

3.1.1 General

The existing 33KV transmission system in QWS located in the center of the city consists of two overhead lines fed from Kampala South substation (KSS).

QWS feeds 11KV line to the center of city through 33/11KV step-down transformers.

As described in the aforesaid section 2.2.2, the existing 33KV lines fed from KSS are planned to be fed from Mutundwe substation (MTS) which station will be newly constructed by the Second Power Project.

3.1.2 Present site arrangement

QWS is located on the south side of the center of the city and faces Queensway road.

The site area is approx. 1600 m2 (46m x 36m) on flat grand. The layout drawing is given in Drawing No.2 "Site arrangement of QWS".

Two 33KV lines fed from Kampala South substation (KSS) are coming from south side to the site. 33KV outdoor switchgear yard and 33/11KV power transformers are located at the middle section in the site.

The 11KV indoor type switchgear is installed in the plant house made of concrete located at a corner of the site.

3.1.3 Present situation of the equipment

The existing QWS consists of the following major equipment:

- 1 : 33KV overhead coupling bay with two line switches
- 2 : Power transformers 33/11KV, 10/14MVA
- 2 : 11KV transformer feeders
-11 : Indoor 11KV switchgear with oil type circuit breakers in plant house

including:
2 : Transformer feeders
1 : Bus coupling
8 : Line feeders
1 : Station auxiliary transformer

33KV transmission line

The existing 33KV incoming lines end in transformers which have not been equipped with circuit breakers for the transformer protection.

The line switches which are installed to disconnect the line are only used for maintenance.

When an accident such as short circuit or earth fault occurs (which are mainly caused by birds), the circuit breaker in KSS which is located about 2.5 km far from QWS trips in order to protect the line.

That is to say, if operators in QWS find an accident in the station, they are not able to solve the problem quickly because there is no circuit breaker for 33KV incoming line.

In addition, communication system (pilot wire system) is not operating properly, therefore, operators and maintenance staff work under dangerous conditions.

11 KV distribution line

The 11KV switchgear with oil type circuit breakers which were installed in 1984 are becoming obsolete because of the lack of spare parts.

During heavy rains in rainy season, the water level in the drain channel around the site rises up over the equipment foundation level. This expedites the deterioration of the equipment as well as directly causing trouble.

Spare parts for the switchgear are difficult to obtain since the type of equipment installed is now obsolete.

Switchgear designed for manual operation is unable to respond quickly during fault conditions or transfer.

Leakage of oil in some circuit breakers is observed.

33/11KV power transformers

On the transformers, the following types of damage are observed:

- Oil leakage
- Malfunction of tap-changer control
- Malfunction of cooling fans
- Malfunction of oil and winding temperature indicators
- Damaged bushings
- Damaged paint

In particular, the damaged on-load tap-changer causes unstable energy supply to the consumers fluctuating voltage as well as difficulties in parallel operation of both transformers for stable power supply.

To overcome the above defects, UEB plans to rehabilitate the transformers using their own budget.

Regarding the mechanical protection for the transformers, the following protection measures have been used:

- Buchholz relay
- HV and LV Winding temperature
- Oil temperature

Moreover the Design Report 1989 describes that the capacity of the existing transformers will meet the forecast demand in the year 2000.

Unfortunately in 1991, the recorded maximum demand in QWS is 28.8MVA. Therefore countermeasure for the transformer capacity is required before the completion of the second power project which is scheduled for 1995.

3.1.4 Planned location of the future extension

There is a space of 400 m^2 (40m x 10m) for future extension at the side of Queensway road.

In order to minimize unserved energy due to the new equipment installation, it would be preferable to utilize this space for the Project.

However the existing station auxiliary transformer on structure is currently located in this space. It is recommended that UEB re-locates the transformer prior to commencement of the Project.

In order to avoid flooding, the ground level of the space for the new equipment should be raised 1.5m up from the existing level by UEB in accordance with the Study Report 1989.

3.2 Motor Mart switching station (MMS)

3.2.1 General

Motor Mart switching station (MMS) is placed in a corner of a private building described as an Insurance house.

MMS is located just center of the city for the purpose of distributing 11KV feeders to essential social and/or governmental buildings such as Bank of Uganda, Uganda Commercial Bank, Rail way station, post office, UEB building, etc.

Two 11KV incoming feeders to MMS are fed from QWS.

3.2.2 Present site arrangement

All the equipment in MMS is installed in a plant house (5.6m x 5m) located in the Insurance house.

Cables of 11KV incoming/outgoing feeders are directly buried in the ground. The cables are armoured cable type.

3.2.3 Present situation of the equipment

MMS consists of 11KV indoor switchgear with oil type circuit breakers and an 11KV/433V transformer.

The 11KV switchgear has the following feeders:

- 2 : 11KV incoming feeders
- 5 : 11KV outgoing feeders
- 1 : 11KV/433V transformer feeder

The switchgear and transformer were all installed during the 1950's. The equipment types are now obsolete. Spare parts, therefore, are no longer available for proper maintenance.

For the switchgear, oil leakage was observed in several portions of the equipment.

Consequently the distribution system in MMS is in poor operational condition.

3.2.4 Planned location of the future extension

Planned location is given in Drawing No.8 "Site arrangement of MMS".

UEB have been requested by the owner of the existing building to remove the existing switchgear.

UEB therefore has proposed a plan to install new switchgear in a space on governmental land which is located 20m from the existing location.

At the request of UEB, Kampala city council, an authority of the land, has already issued a land premium and ground rent demand note to UEB since 1989. The rent land space is 13m x 10m.

Since the land is on a slope, UEB is required to make clear and flat land for the Project in accordance with equipment layout plan and implementation plan which will be indicated in the final report.

3.3 11KV distribution network

3.3.1 General

The 11KV distribution network in Kampala city was mostly constructed during 1950's. The network is now in a very poor operating condition.

The major problems UEB faces at present are summarized as follows:

- Deteriorated facilities
- Lack of regular maintenance due to shortage of spare parts and maintenance vehicles
- Rapid increase of population
- Limited clearance of rapid growing bush along the distribution lines.
- Poor house installation

Consequently, overloads of transformers in the city have increased. the existing underground cables need to be repaired continuously, and at least half of the installed wooden poles are rotten.
In order to provide a stable power supply to the city, therefore, the distribution system needs to be repaired, overhauled and updated.

3.3.2 Organization of maintenance control

For the maintenance of the 11KV distribution lines in Kampala, the following responsibilities have been assigned:

(1) For routine maintenance : Kampala district office of the Distribution section

- Total No. of employees : 245 persons
- Superintendent : Senior district manager at Kampala district office

(2) For material control : Store department of depot section in Lugogo

- Total No. of employees : 70 persons
- Superintendent : Depot manager in Lugogo

For material control, the chief operation manager in UEB headquarters supervises the Depot section in Lugogo.

3.3.3 Present situation of 11KV distribution materials

Present situation

Inventory control for all the materials of networks is done by the central depot in Lugogo. In the store, material control is done by means of log book, material code system, etc.

According to UEB, several materials such as insulators, poles, etc., have been provided by past projects through several agencies, i.e., ODA, EEC, etc.

When the team visited the store, however, it was confirmed that most of the materials which are requested by UEB for the Project, e.g., cork sheet, manila ropes, surge arrestors, etc., are not kept in sufficient stock.

In addition, it was observed that most of the maintenance vehicles are out of order or are damaged, due to deterioration, lack of spare parts, etc.

Materials requested by UEB

According to UEB, the materials requested for the Project will be sufficient only for the maintenance of the 11KV distribution system in Kampala district for one year.
UEB also confirmed that these materials have not been requested from other agencies.

The purpose of the materials requested from the Project can be categorized as follows:
(A) Protection of distribution transformers
(B) Protection of distribution lines from faults originating from houses and small scale industries
(C) Maintenance of 11KV distribution cables
(D) Maintenance of distribution transformers
(E) Installation and replacement of pole and distribution transformer
(F) Replacement of faulty equipment such as transformers and auto-reclosers

Table-4 shows the list of the materials categorized according to the above uses. As shown in the Table-4, it has been clarified that the type of JP Fuse, Item No.1, should be 80A.

Table-4 List of 11KV Distribution Materials with Their Purpose of Use

NO.	DESCRIPTION	PURPOSE OF USE
1	JPU FUSE 80A	A
2	JPU FUSE 160A	A
3	JPU FUSE 315A	A
4	JPU FUSE 400A	A
5	HRC FUSE 60/80A	B
6	INTERIOR CUT OUT 150A	B
7	INTERIOR CUT OUT 300A	B
8	60/80A SP HOUSE SERVICE CUT OUTS	B
9	ELEMENTS SLOW BURNING 5A	A
10	ELEMENTS SLOW BURNING 15A	A
11	ELEMENTS SLOW BURNING 25A	A
12	70 SQMM 11KV 3C PILC(OR XLPE) CU CABLE	C
13	CORK SHEET 1.2Mx1.2Mx3MM	D
14	CORK SHEET 1.2Mx1.2Mx6.4MM	D
15	CORK SHEET 1.2Mx1.2Mx1.6MM	D
16	MANILA ROPES 24MM(88KG) IN COILS	E
17	MANILA ROPES 16MM(42KG) IN COILS	E
18	MANILA ROPES 12MM(23KG) IN COILS	E
19	PREFORMED PT MAKE OFF FOR 7/8 SWG STAY WIRE	E
20	PREFORMED PT MAKE OFF FOR 7/12 SWG STAY WIRE	E
21	PREFORMED WRAP GUY GRIPS FOR 7/8 SWG STAY WIRE	E
22	PREFORMED WRAP GUY GRIPS FOR 7/12 SWG STAY WIRE	E
23	TURN BUCKLES 10"x5/8" EYE EACH END	E
24	TURN BUCKLES 10"x3/4" EYE EACH END	E
25	SILICA GEL IN 25KG PACK	A
26	25KVA SINGLE PHASE 11KV/LV TRANSFORMER	F
27	50KVA THREE PHASE 11KV/LV TRANSFORMER	F
28	100KVA THREE PHASE 11KV/LV TRANSFORMER	F
29	315KVA THREE PHASE 33KV/LV TRANSFORMER	F
30	SURGE ARRESTOR 11KV	A
31	SURGE ARRESTOR 33KV	A
32	AUTORECLOSER 11KV	E

3.3.4 Present situation of maintenance vehicles

For maintenance work on the distribution line, Kampala district office consisting of 245 persons have been using 16 vehicles in total.

However almost all the vehicles are out of order or in bad condition, e.g., broken meter and front glass, malfunction of hydraulic system of loading facility of lorry, etc., because of deterioration of equipment, lack of spare parts, etc.

Also UEB reported that the number of vehicles available at present is not enough in comparison to the volume of work.
The mileage of some vehicles records as over 150,000km for vehicles procured only 4 years ago.

Under this situation, UEB faces mobility problems. It can not cope up with the proper maintenance of the distribution system and in responding quickly to break downs in the systems.

4. Conceptional plan for the Project

4.1 General

This section describes the basic concepts for design and installation of the new switchgear in QWS and MMS as well as the material procurement for the Project, if Grant Aid is extended.

However this basic concept is subject to the approval of the Japanese Government.

4.2 Queensway substation (QWS) and Motor Mart switching station (MMS)

4.2.1 Design concept

As a result of the field survey on the present site conditions such as site location, arrangement of the existing facilities as well as future extension and rehabilitation plans by UEB, the following items shall principally be considered for the design:

(1) Power demand forecast given in the Design Report 1989 shall be applied to the Project.

(2) Outdoor cubicle type switchgear will be adopted so that the construction period and power outage caused by the construction will be minimized as much as possible.

(3) Easy maintenance will be considered.

(4) Vacuum circuit breaker will be installed in consideration with easy maintenance.

(5) The existing power transformers in QWS will be rehabilitated by UEB in order to maintain proper functioning of the equipment.

(6) IEC, ISO and Japanese codes and standards shall be applied.

4.2.2 Design conditions

Considering the site location and surrounding circumstances, the following design conditions shall be applied for the Project:

(1)	Altitude	: about 1300m
(2)	Ambient temperature	: maximum 40^{0}C minimum 15^{0}C average 23^{0}C
(3)	Relative humidity	: maximum 100% minimum 20%
(4)	Rain fall	: average annual 1100mm
(5)	Seismic acceleration	: 0.1g (Horizontal)
(6)	Hail	: to be considered
(7)	Dust	: to be considered
(8)	Soil bearing capacity	: minimum 3 ton/m^2
(9)	Frequency	: 50Hz
(10)	System fault level	: 33KV line 16KA (sym) 11KV line 20KA (sym)
(11)	Rated current of bus bar	: 33KV line 2000 A 11KV line 2000 A

4.2.3 Outline of major equipment

Each station will consist of the following major equipment:

The detailed specifications of major equipment is given in Annex-1.

(1) Queensway substation (QWS)

a) 33KV outdoor type metal-clad switchgear consisting of:

- 1 set : 33KV Busbar and coupling section
- 2 sets : 33KV Transformer feeders
- 4 sets : 33KV Line feeders

b) 11KV outdoor type metal-clad switchgear consisting of:

- 1 set : 11KV Busbar and coupling section
- 2 sets : 11KV Transformer feeders
- 12 sets: 11KV Line feeders
- 2 sets : Station transformer feeders
- 1 set : SCADA interface marshalling cubicle

- 1 set : DC110V battery system

c) Power transformers (existing)

- 2 sets of the existing power transformers (33/11KV, 50Hz, 10/14MVA, ONAN/OFAF, YyO) with control cubicle including voltage regulating device will be used for the Project.

(2) Motor Mart substation

a) 11KV outdoor type metal-clad switchgear consisting of:

- 3 sets : 11KV Incoming line feeders
- 6 sets : 11KV Outgoing line feeders
- 2 sets : 11KV Coupling section (busbar sectionalizer)
- 1 set : Station transformer feeder
- 1 set : DC110V battery system

b) Station transformer (Outdoor type)
- 1 set : Station auxiliary transformer

4.2.4 Outline of system composition

For the outline of system composition, Oneline Diagrams for QWS and MMS are given in Drawing No.3 and 9, respectively.

Work demarcation plan for the Project is also shown in the drawings.

Regarding the protection system, DC control power source, etc., the team would like to propose the following system instead of UEB's specifications which have been provided to the team for reference.

Protection system

As shown in the oneline drawing, combination with the following relay will be introduced:

- Differential relay (87)
- Overcurrent relay with high speed operation (51, 51H)
- Overcurrent ground relay with high speed operation (51G)
- Overvoltage ground relay (64V)

Major reasons for the introduction are as follows:

- Differential protection system is currently used method of protection for transformer with large capacity.
- Differential protection system has most reliability and accuracy for transformer's internal failure.
- The protection method with above combination is normal way being used in Japan.

Regarding distance relay for 33KV line feeder, the team will be undertaking further study in Japan based on the information provided by UEB.

The pilot relay system will not be considered in the Project.

DC power source

For the purpose of DC power supply for control and protection of the equipment, DC110V battery system with outdoor type cubicle will be installed.

Major reasons of the introduction of DC110V system instead of DC30V system in UEB's specifications are as follows:

- It is a standard voltage level for control and protection of circuit breaker and protection relays in Japan.
- It has been used internationally base on IEC standard.
- It has been introduced by UEB for 132KV substation.

Load break switch for station transformer

Considering the safety of operation and maintenance, manual type load break switched for station transformer will be adopted instead of spring mechanism and motor operation type.

Voltage regulation device

The existing voltage regulation device in 33KV transformer line which are equipped with the existing transformer control panel should be repaired by UEB, for the Project.

Protection class of switchgear

Protection class IP23 will be adopted for outdoor type switchgear, instead of IP42 in UEB's specifications, by the following reasons:

- It has enough capability for outdoor type cubicle.
- There are so many installation records of outdoor type switchgear with IP23 protection class in Japan, also in African country.

4.2.5 Equipment layout plan

In the light of present situation of the sites (aforesaid section 3.1 and 3.2), new equipment composition, easy maintenance, minimization of outage of power supply due to construction, etc., the new switchgear will be installed as the following drawings:

For Queensway substation : Drawing No. 4 - 6

For Motor Mart switching station : Drawing No. 8 - 11

For the switchgear arrangement in QWS, as an alternative plan Drawing No. 7 can also be considered.

The alternative plan in which 33KV and 11KV switchgear will be installed facing each other seems to make for easy maintenance. However, considering the present site arrangement as well as minimizing outages, it would be recommended to install new switchgear in accordance with Drawing No. 6 (Straight line arrangement).

4.2.6 Existing facility and equipment to be used

The following existing facilities and equipment will be used for the Project:

Queensway substation

- Power transformers with control cubicle
- Terminal gantry structures of 33KV transmission line

Motor Mart substation

- Not applicable

4.3 11KV distribution materials and maintenance vehicles

Specifications for the 11KV distribution materials and maintenance vehicles will be studied in Japan based on the information provided by UEB including the specifications which are prepared by UEB for reference, existing material supplier's list, etc.

5. Undertakings by the Government of Uganda

The undertakings by the Government of Uganda are described in the Minutes of discussions (M/D) concluded on February 12, 1991.

In addition to the above, necessary measures for the following additional notes and/or items shall also be taken by the Government of Uganda if Grant Aid is extended.
Items marked with "*" show additional items to M/D.

(1) To provide cleared and leveled land for the Project.

* All the works shall be done and completed in accordance with a site layout plan and an implementation plan which will be indicated in the final report.

(2) To provide the land for temporary site office, warehouse and stock yard during the implementation period.

* The space, about 300 m^2 in Queensway substation will be required. Please refer to the site arrangement attached herewith.

(3) To supply and construct the cables for incoming and outgoing feeders outside the scope of Japan's Grant Aid for Queens Way substation and Motor Mart switching station.

* This work shall be completed in accordance with an implementation schedule which will be indicated in the final report.

(4) To repair the existing transformers of Queens Way substation which shall be used for the Project in order to ensure the proper operation.

* This work shall be completed in accordance with an implementation schedule which will be indicated in the final report.

* This work shall also include the supply of voltage regulating device, alarm signal of transformer in the existing transformer control cubicle.

(5) To dismantle and remove the existing equipment and facilities not to be used for the Project in Queens Way substation and Motor Mart switching station.

* This item shall include relocation of the existing station auxiliary transformer, structures and their foundations in Queensway substation prior to the commencement of the construction for new equipment.

* (6) To provide necessary budget and personnel for proper and effective operation and maintenance of the Project components to be provided under the Grant Aid.

* (7) To provide a bench mark at the sites.

* (8) To provide site drainage system and fence at the sites. Also, to provide outdoor lighting system, fire fighting system, telecommunication system at sites, etc., if necessary.

* (9) To provide necessary drawings for the detailed design of the Project, including drawings of site grading plan, the existing transformers, information of SCADA system, etc., in accordance with an implementation schedule in the final report.

Detailed Specifications for Switchgear

Each switchgear cubicle will consist of the following components:

1. Queensway substation

1.1. 33KV outdoor type metal-clad switchgear

1.1.1 33KV Busbar and coupling section (1 set)

- 2 Busbar system, 2000A
- 1 Withdrawable type vacuum circuit breaker, 1250A, 25KA(sym)
- 1 Current transformer for protection and measuring
- 2 Inductive voltage transformer (3units each)
- 1 Voltmeter for each busbar with change-over switch indicating the values between phase
- 1 Ammeter with overshot range inclusive with 4 position selector switches
- 3 Overcurrent relay with high speed operation
- 1 Trip circuit supervision relay with two coils indicating circuit breaker open and closed and one coil with flag for alarm indicator
- 1 Test link boxes
- 1 Control switches or push buttons for operation of circuit
- 1 Position indicator for circuit breaker and isolator earthing switch
- 1 Alarm annunciator with two spare sections at least

1.1.2 33KV Transformer feeder (2 sets)

- 1 Withdrawable type vacuum circuit breaker (1250A, 25KA(sym)) with earthing switch
- 1 Current transformers for protection (2cores) and measuring
- 1 Ammeter with overshot range with maximum demand pointer
- 3 Overcurrent relay with high speed operation
- 1 Overcurrent ground relay
- 1 Trip circuit supervision relay for indicating on-off position for circuit breaker ad alarm indicator
- 1 Test link boxes
- 1 Control switches or push buttons for operation circuit breaker and isolator/earthing switch
- 1 Position indicator for circuit breaker and isolator earthing switch
- 1 Sockets and plug-in sealing and for connection of HV cables to the switchgear
- 1 Alarm annunciator with two spare section at least
- 1 Inductive voltage transformer
- 1 Voltmeter with selector switch 7 positions
- 1 Active power indicator (MW)
- 1 Reactive power indicator (MVar)

- 1 Overvoltage ground relay
- 1 Differential relay

1.1.3 33KV Line feeder (4 sets)

- 1 Withdrawable type vacuum circuit breaker (630A, 25KA(sym)) with earthing switch
- 1 Current transformers for protection (2 cores) and measuring
- 1 Capacitive voltage transformer for neon voltage
- 1 Ammeter with overshot range with maximum demand pointer
- 3 Overcurrent relay with high speed operation
- 1 Overcurrent ground relay
- 1 Autoreclosing relay
- 1 Trip circuit supervision relay for indicating on-off position for circuit breaker and alarm indicator
- 1 Test link boxes
- 1 Control switches or push buttons for operation circuit breaker and isolator/earthing switch
- 1 Position indicator for circuit breaker and isolator earthing switch
- 1 Sockets and plug-in sealing and for connection of HV cables to the switchgear
- 1 Alarm annunciator with two spare section at least

1.2 11KV outdoor type metal-clad switchgear

1.2.1 11KV Busbar and coupling section (1 set)

- 2 Busbar systems, 2000A
- 1 Withdrawable type vacuum circuit breaker, 2000A, 25KA(sym)
- 1 Current transformers for protection and measuring
- 2 Inductive voltage transformers (3 units each)
- 1 Voltmeter for each busbar with change-over switch indicating the value between phases
- 1 Ammeter with overshot range inclusive with 4 position selector switches
- 3 Overcurrent relay with high speed operation
- 1 Trip circuit supervision relay for indicating on-off position for circuit breaker and alarm indicator
- 1 Test link box
- 1 Control switches or push buttons for operation of circuit breaker
- 1 Position indicator for circuit breaker
- 1 Alarm annunciator with two spare sections at least
- 2 Overvoltage ground relay

1.2.2 11KV Transformer feeder (2 sets)

- 1 Withdrawable type vacuum circuit breaker (2000A, 25KA(sym)) with earthing switch
- 1 Current transformers for protection (2 cores) and measuring
- 1 Inductive voltage transformer
- 1 Voltmeter with selector switch, 7 positions
- 1 Ammeter with overshot range with maximum demand pointer
- 3 Overcurrent relay with high speed operation

- 1 Overcurrent ground relay
- 1 Trip circuit supervision relay for indicating on-off position fir circuit breaker and alarm indicator
- 1 Test link boxes
- 1 Active power indicator (MW)
- 1 Reactive power indicator (MVar)
- 1 Kilowatt hour meter with MD indicator
- 1 Control switches or push buttons for operation of circuit breaker and earthing switch
- 1 Position indicator for circuit breaker and isolator earthing switch
- 1 Alarm annunciator with two spare sections
- 1 Overvoltage ground relay

1.2.3 11KV Line feeder (12 sets)

- 1 Withdrawable type vacuum circuit breaker (1250A, 25KA) with earthing switch
- 1 Current transformers for protection (2 cores) and measuring
- 1 Capacitive voltage transformer for neon voltage indication
- 1 Auto-reclosing relay
- 3 Overcurrent relay with high speed operation
- 1 Overcurrent grounding relay
- 1 Trip circuit supervision relay for indicating on-off position for circuit breaker and alarm indicator
- 1 Test link boxes
- 1 Control switches or push buttons for operation of circuit breaker
- 1 Position indicator for circuit breaker
- 1 Alarm annunciator with two spare sections

1.2.4 11KV Station transformer feeder (2 sets)

- 1 Load break switch with manual operation including HV fuses
- 1 Station transformer
- 1 Mold case circuit breakers
- 1 Position indicator for load break switch
- 1 Alarm annunciator with two spare sections
- 1 Capacitive voltage transformer for neon voltage indication

1.2.5 SCADA interface marshalling cubicle (1 set)

1.2.6 DC110V Battery system (1 set)

2. Motor Mart switching station

2.1 11KV outdoor type metal-clad switchgear

2.1.1 11KV Incoming line feeder (3 sets)

- 1 Withdrawable type vacuum circuit breaker (2000A, 25KA(sym)) with earthing switch
- 1 Current transformers for protection and measuring
- 1 Inductive grounding voltage transformer
- 1 Voltmeter with selector switch

- 1 Ammeter with overshot range with maximum demand pointer
- 3 Overcurrent relay with high speed operation
- 1 Overcurrent ground relay with high speed operation
- 1 Overground voltage relay (three feeder only)
- 1 Kilowatt-hour meter with MD indicator
- 1 Active power indicator

2.1.2 11KV Outgoing line feeder (6 sets)

- 1 Withdrawable type vacuum circuit breaker (1250A, 25KA(sym)) with earthing switch
- 1 Current transformers for protection and measuring
- 1 Inductive grounding voltage transformer
- 1 Voltmeter with selector switch
- 1 Ammeter with overshot range with maximum demand pointer
- 3 Overcurrent relay with high speed operation
- 1 Overcurrent ground relay with high speed operation
- 1 Overground voltage relay (three feeder only)
- 1 Kilowatt-hour meter with MD indicator
- 1 Active power indicator

2.1.3 11KV Coupling section (busbar sectionalizer) (2 sets)

- 1 Withdrawable type vacuum circuit breaker, 2000A, 25KA(sym)

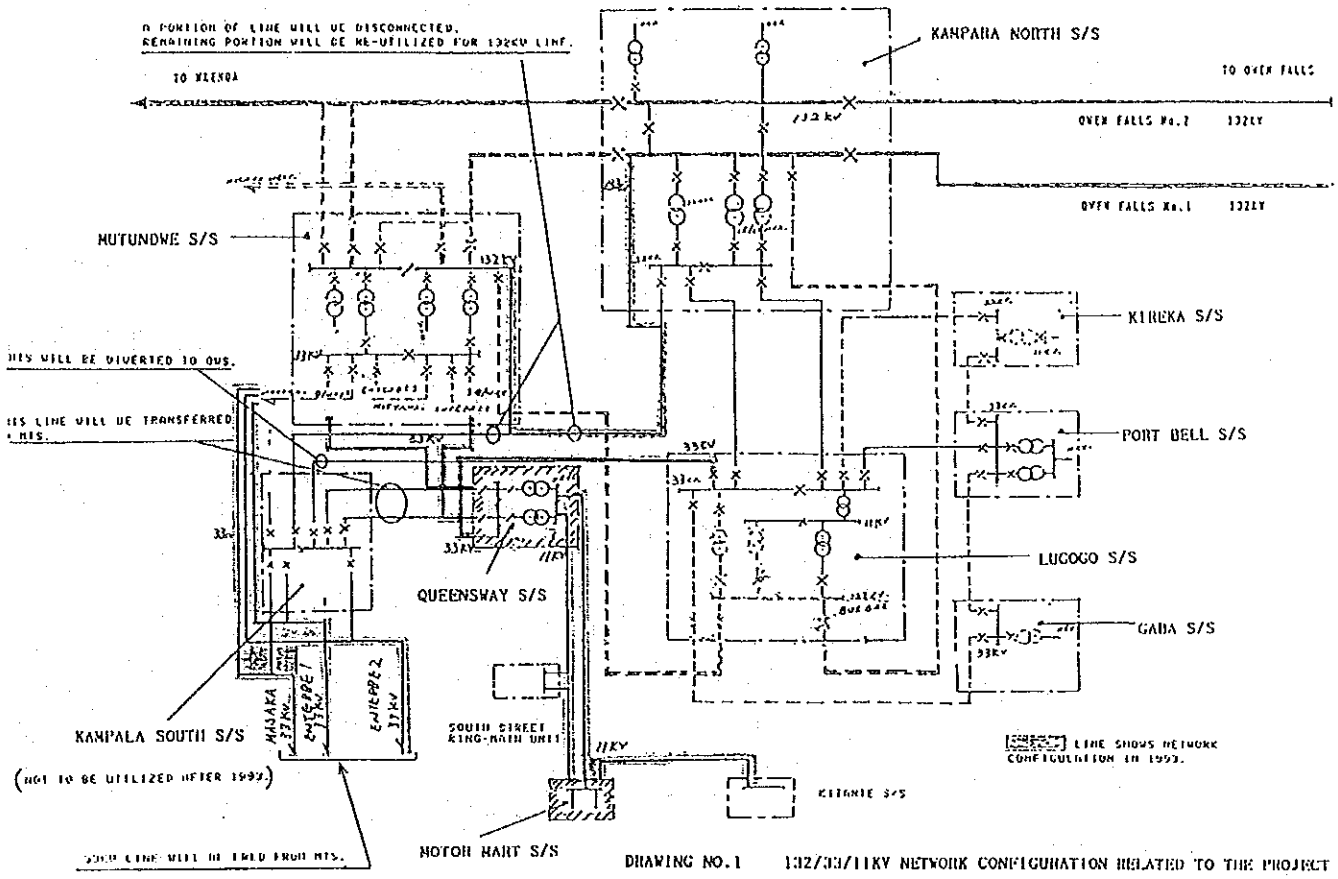
2.1.4 Station transformer feeder (1 set)

- 1 Load break switch with manual operation including HV fuses and three phase switch release

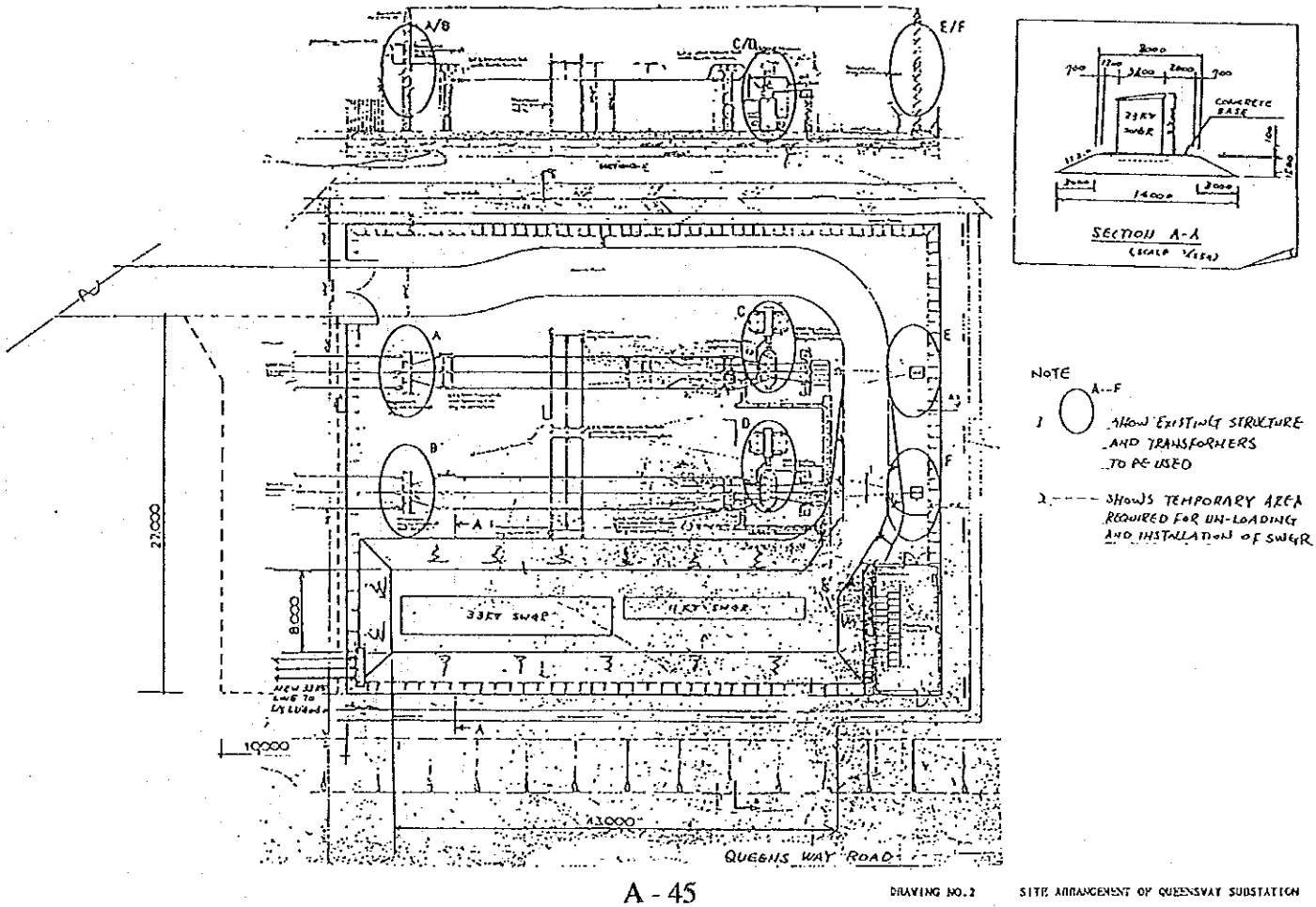
2.1.5 DC110V Battery system (1 set)

2.2 Station transformer (1 set)

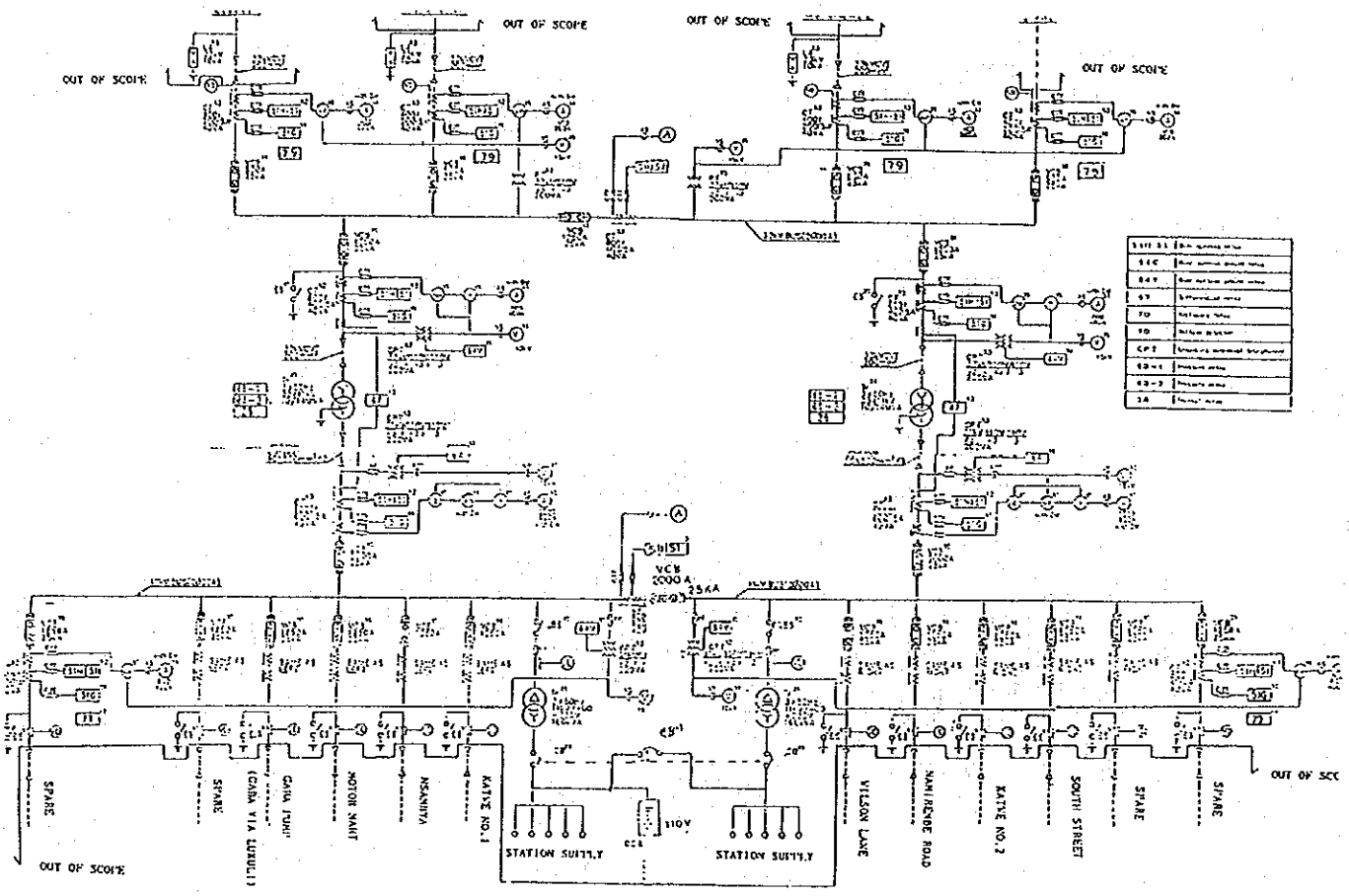
- 1 Station transformer, 11KV/433V 50Hz, 500KVA, Dy11



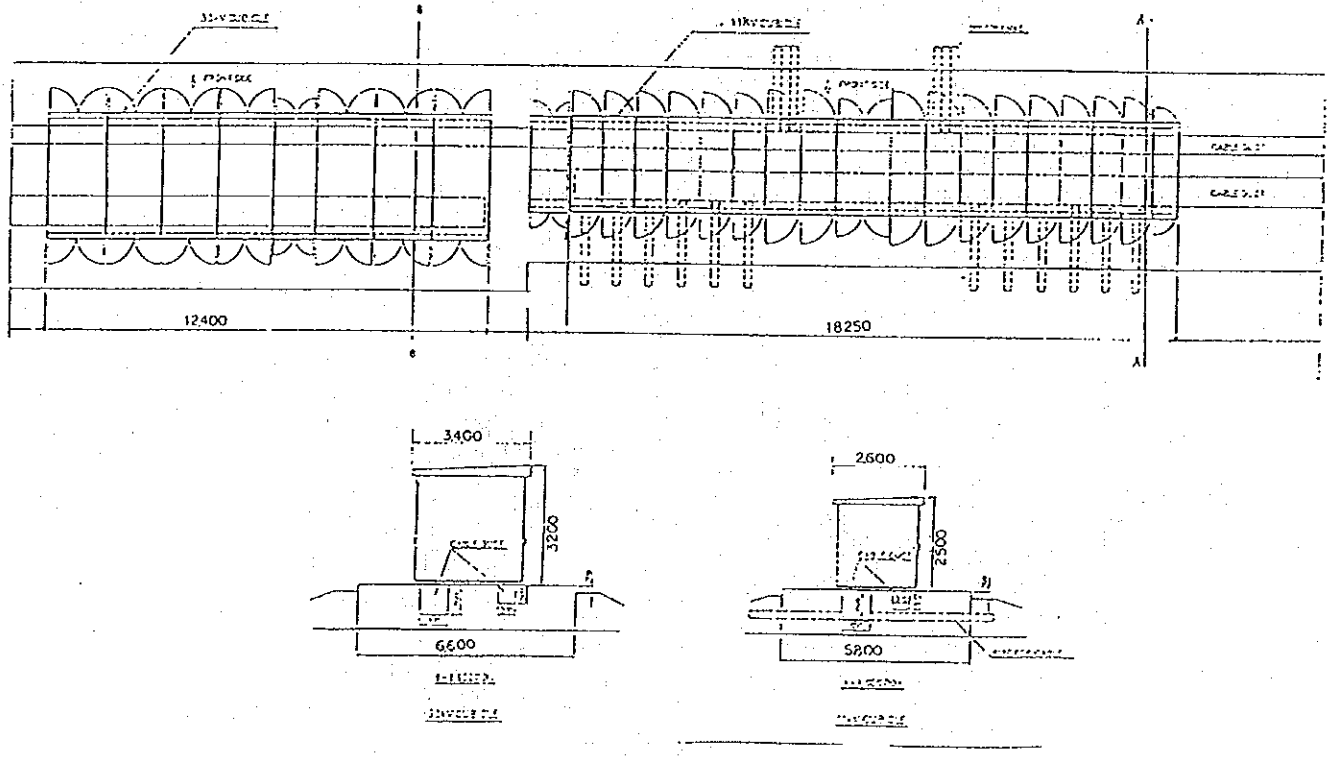
DRAWING NO.1 132/33/11KV NETWORK CONFIGURATION RELATED TO THE PROJECT



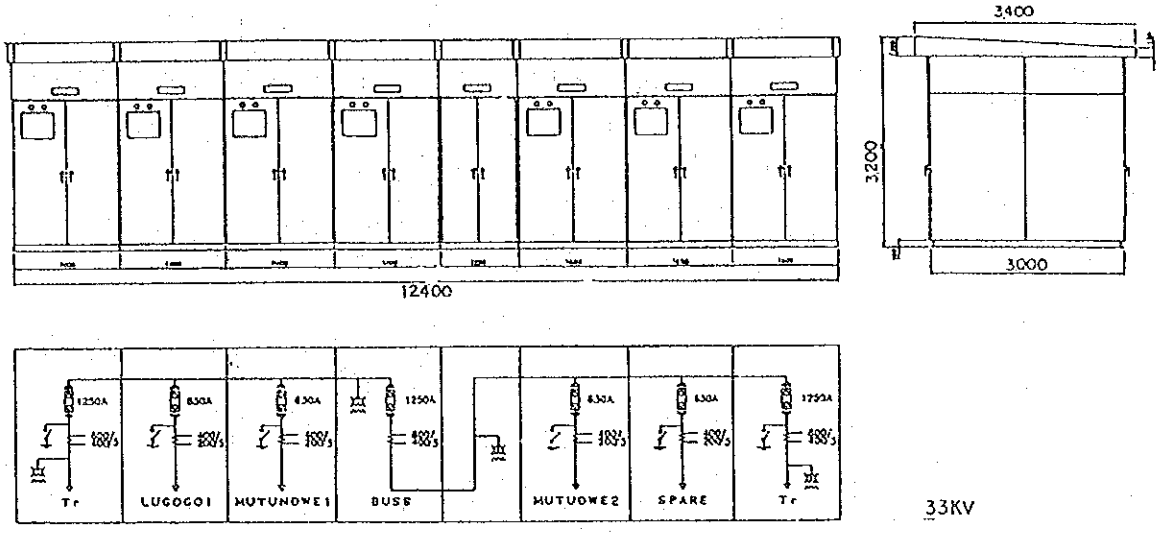
DRAWING NO.2 SITE ARRANGEMENT OF QUEENSWAY SUBSTATION



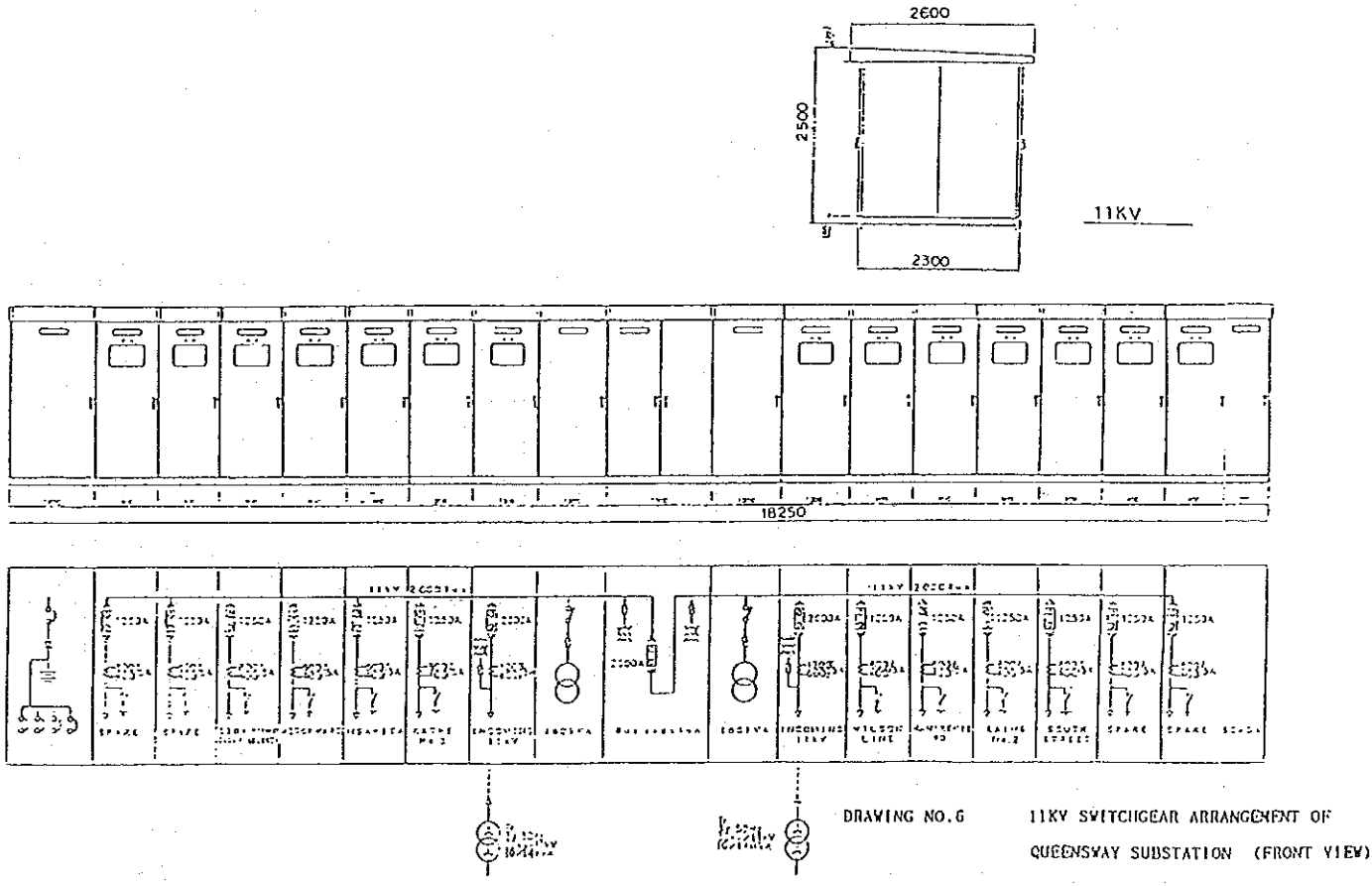
DRAWING NO.3 OUTLINE DIAGRAM OF QUEENSWAY SUBSTATION



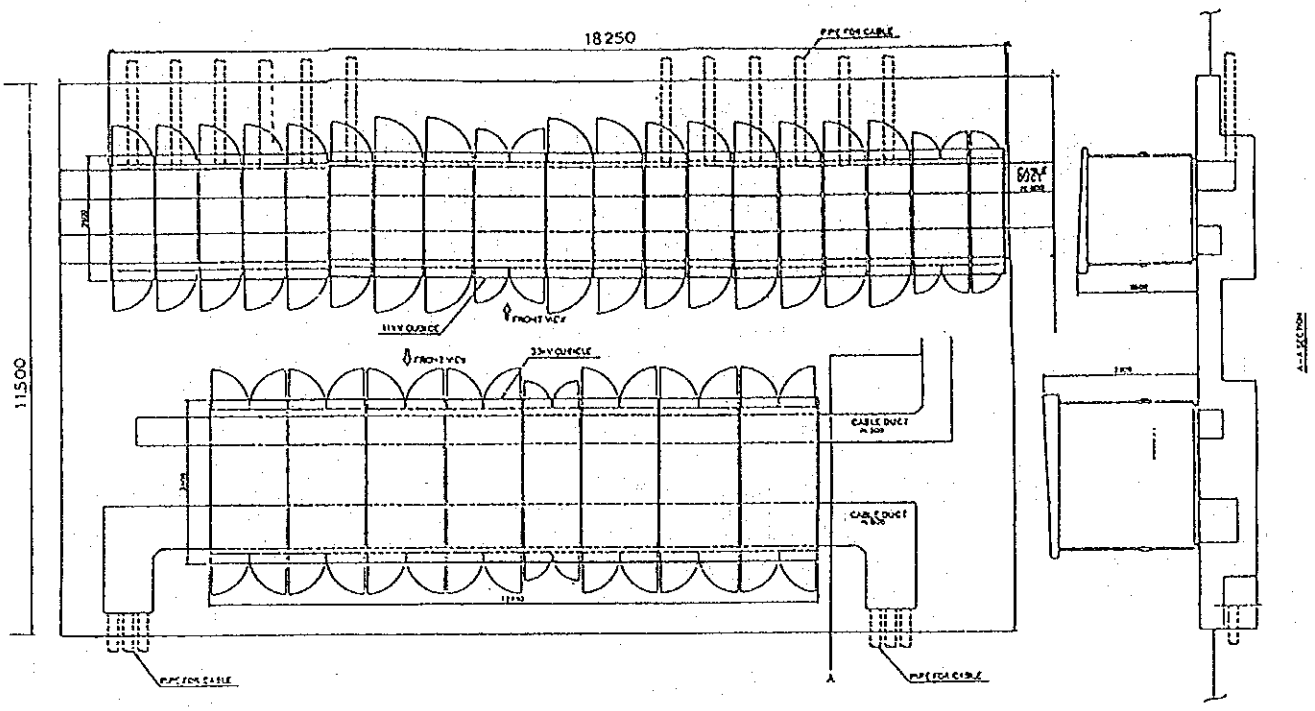
DRAWING NO.4 SWITCHGEAR ARRANGEMENT OF QUEENSWAY SUBSTATION (PLAN)



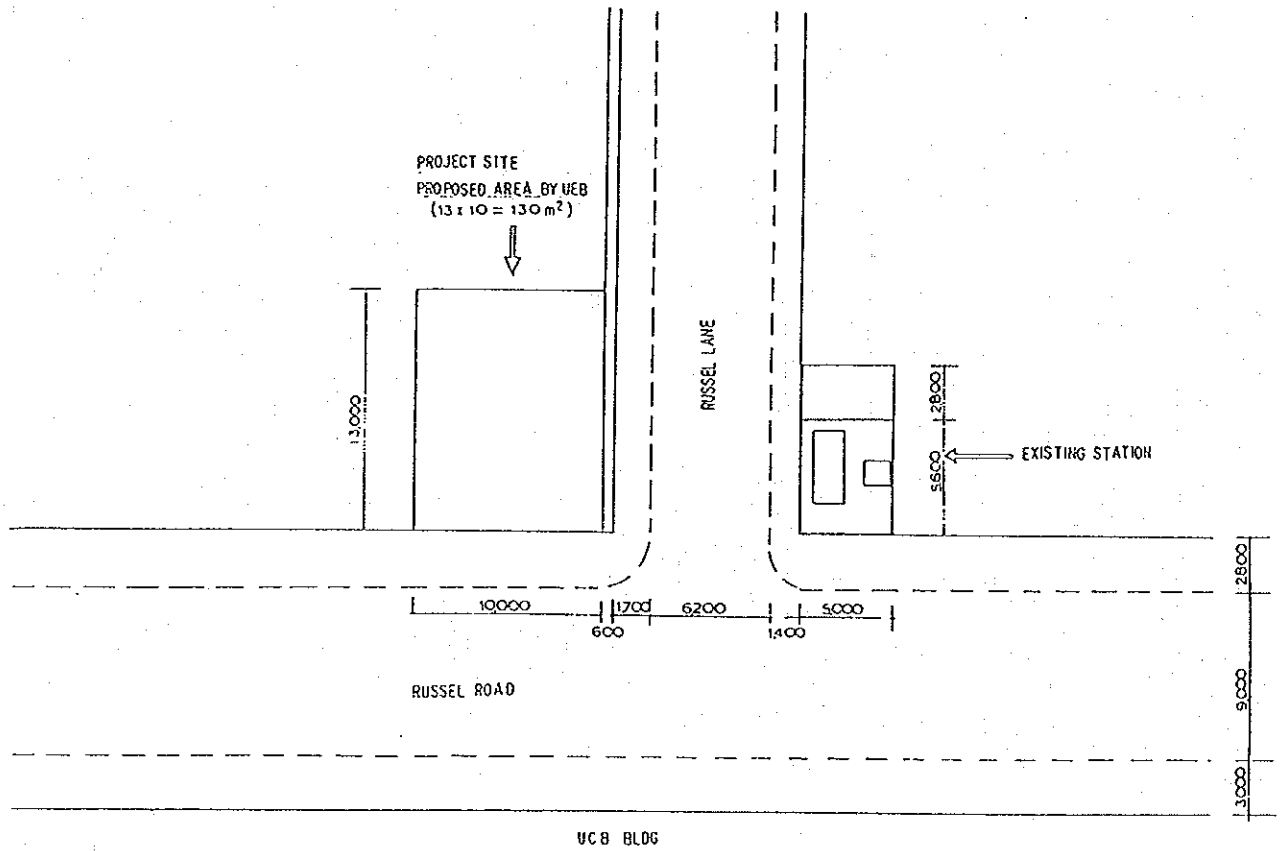
DRAWING NO.5 33KV SWITCHGEAR ARRANGEMENT OF QUEENSWAY SUBSTATION (FRONT VIEW)



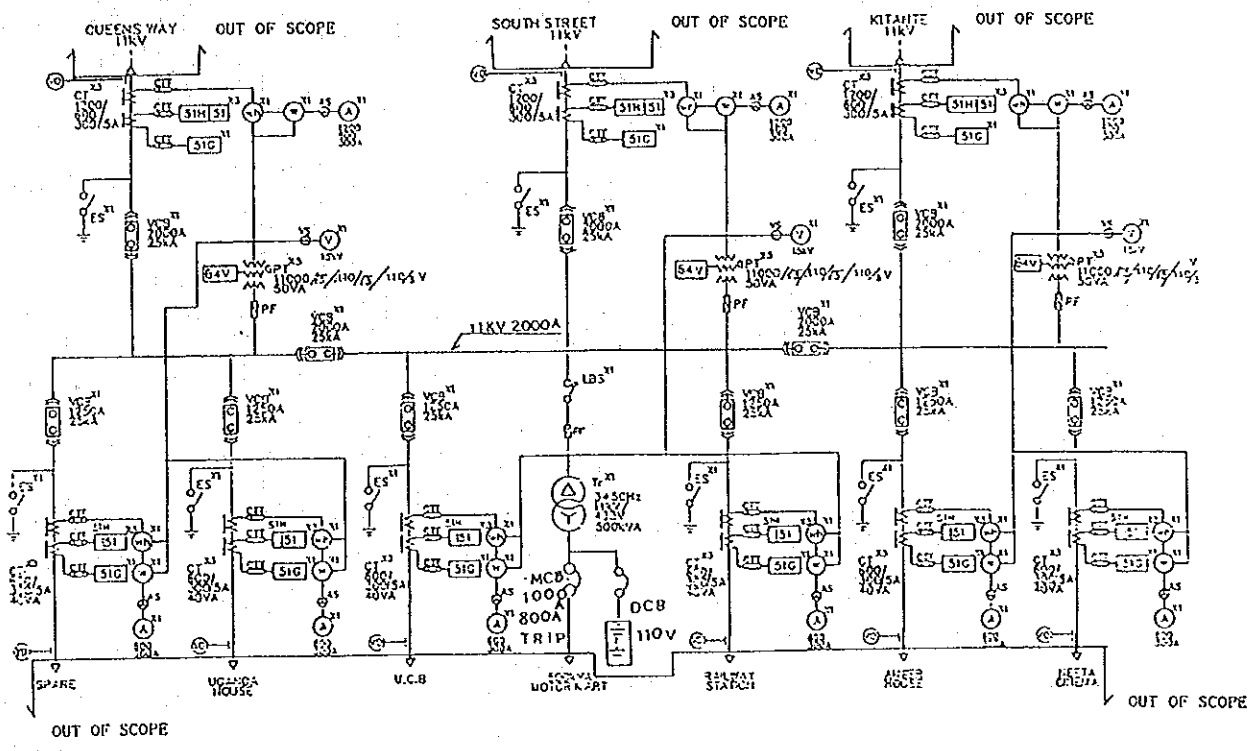
DRAWING NO.6 11KV SWITCHGEAR ARRANGEMENT OF QUEENSWAY SUBSTATION (FRONT VIEW)



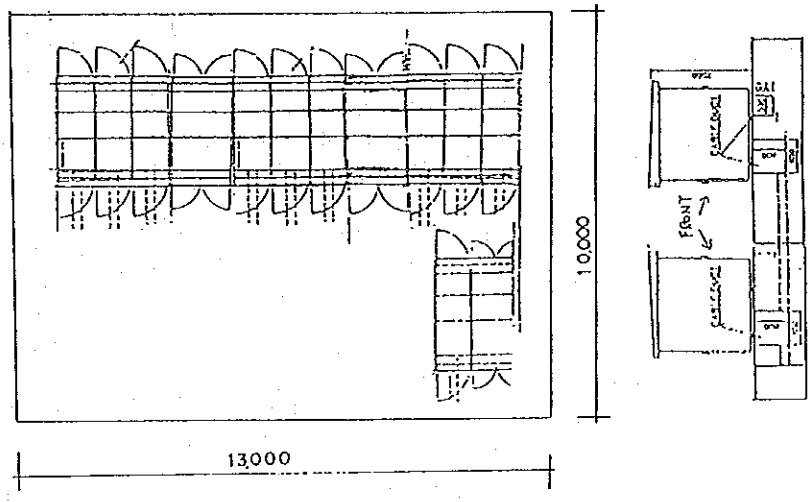
DRAWING NO.7 SWITCHGEAR ARRANGEMENT OF QUEENSWAY SUBSTATION (ALTERNATIVE PLAN)



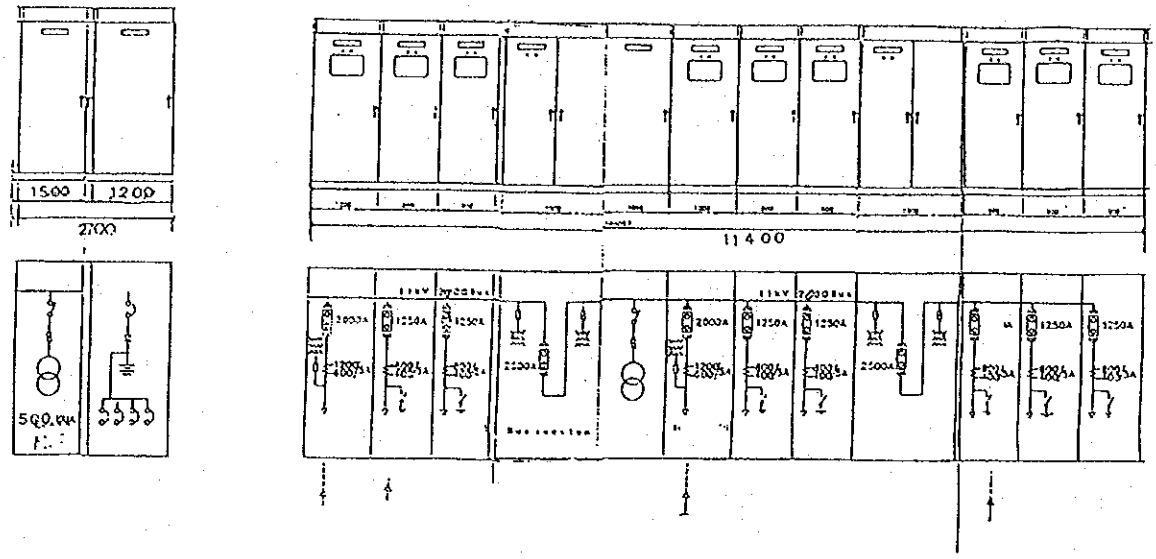
DRAWING NO.8 SITE ARRANGEMENT OF MOTOR KART SWITCHING STATION



DRAWING NO.9 ONELINE DIAGRAM OF MOTOR MART SWITCHING STATION



DRAWING NO.10 SWITCHGEAR ARRANGEMENT OF MOTOR MART SWITCHING STATION (PLAN)



DRAWING NO.11 11KV SWITCHGEAR ARRANGEMENT OF MOTOR MART SWITCHING STATION (FRONT VIEW)

APPENDIX 6

LETTER OF APPROVAL BY GOVERNMENT OF UGANDA FOR THE FIELD REPORT

Mr. Tadao Okabe
Basic Design Study Team Leader
(JICA)
Dear sir

27th February,1991.

REF:EBN/HS/JPS2

SUBJECT:KAMPALA REHABILITATION

Dear Sir,

The Board has read through the field report submitted by the basic design study team, and found the report good and has been approved but have the following comments to make on the report:

1. Cables - Queensway/Motor mart.

Initially U.E.B. intended to link Motor Mart and Queens Way by an 11KV 185 mm sq cable of 1.5km in length. In addition Motor Mart would have to be linked to South Street Ring Main Unit to provide an alternative feed to the substation. The length of this cable is approximately 3.5km. Hence the total length of the cable required is approximately 5km. We are therefore proposing that this cable is included in the project.

2. Queensway - Lugogo Line .

By 1992 there will be a 33KV line from Lugogo to Queensway. This line should terminate through a 33KV 185mm sq cable to the proposed panels. The project should provide approximately 1/2 km of 33KV 185mm sq cable required for the connection.

3. Cables Connecting to the Existing 11KV Network.

As shown from layout diagram of Queensway. Short new pieces connecting the old feeder and the new 11KV switchgear will be required.
A total of 400 metres of 70mm sq 11KV cable should also be provided by the project.

4. New Transformers

The transformers have reached their full capacity. Given the fact that there are damages as given on page 7 of the field report UEB strongly recommends that the project includes two new transformers of 15/20MVA 33/11KV to replace the existing ones.

5. Earth Fault Protection

The system experiences many high impendance earth faults. The project should provide a sensitive earth fault relay.

Yours faithfully,

E.B.NZABANITA,
FOR MANAGING DIRECTOR.

APPENDIX 7

SPECIFICATIONS OF DISTRIBUTION MATERIALS AND OF MAINTENANCE VEHICLES PREPARED BY UEB

BACKGROUND TO DISTRIBUTION MATERIALS AND VEHICLES

1. PURPOSE OF REPORT:

This report gives the background to the distribution materials and vehicles indicated in the appendix 1 together with the purpose of each item. It outlines the benefit to the public if these materials are obtained and their impact on the Kampala City Network improvement.

2. DESCRIPTION OF ITEMS:

The description and specifications of the items are found in appendix 1. These materials are required for system maintanance.

3. BACKGROUND TO THE REQUIREMENTS OF THESE ITEMS:

3.1.1. TRANSFORMER FUSES:

The breakdown of the city infrastructure for the last twenty years has resulted into the following;

1. The previously well treamed trees and fences growing into bushes.
2. The springing up of very many unplanned houses and structures in the city and its suburbs.
3. Over crowded residential houses.
4. Reduction in the provision of alternative cheap source of energy (e.g. charcoal, wood etc) to electrical energy.

5. Uncontrolled city population growth.
6. Poor housing and bad house installations.

As a result of the above reasons, transformer faults due to trees on the over head lines and poor house installations have increased, Overloads of transformers in the city have also increased. This results, at times in overloading the lines and as a result the wires clash. These faults end up blowing the LV fuses and at times the HV fuses. When the store is short of LV fuses solid copper wires are used instead and this leads to the HV fuses blowing. The rate at which they blow is summarised in the fault log book at the district radio room. From this summary the indicated annual requirement shown is worked out. The actual requirements are above that indicated. The number indicated is true simply because the fuses are not available in store therefore fuses are used annually.
The Board however, has introduced measures worked out through an emergency city planning which is intended to reduce faults resulting from the above above cases.
Inspite of the plan HV and LV are still required due to time lag between planning and implementation.
The Board has lost a number of 83 distribution transformers as a result of luck of either LV and HV fuses in Kampala City alone.

3.1.2. HOUSE HOLD AND SMALL SCALE INDUSTRY FUSES:

The housing installation and standards of the small scale industry installations are still in many cases not satisfactory. However, the Ministry of Energy introduced a body authorising contractors for such installation but the control on their work is still not adequate. So in order for the Board to protect its installations these fuses are required in big numbers.

3.2. H.V. CABLES

The Kampala city underground network was installed in the fifities and sixties. The load during those days was relatively small but now it has grown as shown by the load curve for Queensway (see the relevant report). On the other hand the cables have grown old, need constant repairing and at times changing them completely. The predominating size of cable for Kampala City is the 70 sq mm copper.

3.3. GASKETS:

Cork sheets in the different sizes are required for transformers and other equipment. Carrying out preventive maintanance of transformer, changing oil and stopping oil leakages,gaskets are required in large quantities for kampala since the city has about one thousand transformers.

3.4. ROTTEN POLES:

The city network system is over thirty years old. Wooden poles usually have a life time of about twenty five years. There are a number of rooten poles in the Kampala city. There are gangs created to replace these rotten poles. These gangs require ropes for erection of new poles lifting transformers etc. Stay wires and all associated equipments like preformed pole top make off, preformed wrap guy grips, and turn buckles are replaced with replacing an old pole and at times new ones put up where it is felt necessary.

3.5. IMPROVEMENT OF CONSUMER SERVICE AND RELIABILITY

The rate at which the number of consumers to the grid is increasing has resulted in existing distribution transformers in the city getting over loaded. Additional new transformers are required. To meet this increasing demand. To solve this problem, a transformer of higher capacity is required or an additional substation has to be commissioned after establishing the area's load centres.

One reason accounting for most faulty transformers is lightening. faulting is lightening. The area of Kampala in the month of August alone has about eighteen thunder storm days. This clearly shows the high risk of transformers being lit by lightening. Lightening surge arresters if available reduce this risk and improve on the reliability of consumers. Hence the need for surge arrestors.

3.6: VEHICLES:

The Kampala district office has a set up provided by the attached organisation chart. In order for the district to function properly it requires 22 4-wheel drives and 12 lorries. The current situation is as follows. The district manager has a vehicle which is in bad condition while his assistant has none.
There are two district engineers (D.E) overhead and general. They have one vehicle and in poor condition. There are three section engineers each with an assistant. All of them have three 4 wheel drive which are in very very bad condition.
The technical breakdown section has six faultsmen and would require 7 vehicles including their supervisor, three of which are down in the garage.
Two are in good condition while one is in a poor shape and the other is in poor shape and the other is in reasonably satisfactory condition.
In emergency breakdown section there should be two vehicles but one is in poor shape. The installation have one Suzuki which is not adequate for the volume of work They require two more in order to cope up with the work load.
The underground section has two vehicles currently and one has completely broken down. The overhead gang: The district has six gangs, which have had five lorries. Four of them are not moving. They would require an additional self loading lorry Meter reading: They require four vehicles. Currently they have two lorries and one landrover is in bad condition.
The Commercial section has completely one. The Accounts have one vehicle but in poor condition.
The sections having vehicles are indicated on the organisation chart.
The work load at the district would necessitate new vehicles if rehabilitation is to be well completed in time.

4. BENEFIT TO THE PUBLIC:

4.1: Reliability:

With the provision of the distribution materials, the power reliability to the public will be very much improved. We expect to reduce the technical breakdown by 75% through changing of old poles and reduce the causes of transformer break down. Outage times will be very much reduced.

4.2: Economic benefits:

Many industries, like breweries were not producing enough products due to power failures, Uganda Waragi factory was losing a lot of money in unwanted end products after power breakdown. The cost incurred by buying standby/alternative supply due to excessive power failure frequency is enormous. With improved supply, there will be considerable reduction in consumers equipment which will get damaged and hence very few legal disputes.

4.3: Moral benefit:

The frequent power failures are very irritating to the public. They cause distress among the consumers. This is evidenced by the reports and comments published in local papers, but with improved services expected after the reception and implementation of these materials the distress, ill feelings and the irritation of the public will minimised.

4.4: Environmental benefit:

If reliable power is made available to the [illegible] use of charcoal will be reduced hence reducing the environmental degradation caused by tree burning for producing charcoal.

Annexure I.

ITEM	DESCRIPTION	QUANTITY
1	JP FUSES 80A	10000
2	JP FUSES 160A	10000
3	JP FUSES 315A	10000
4	JP FUSES 400A	10000
5	HRC FUSES 60/80A	10000
6	INTERIOR CUT OUT 150A	500
7	INTERIOR CUT OUT 300A	500
8	60/80A SP HOUSE SERVICE CUT OUTS	5000
9	ELEMENTS SLOW BURNING 5A	500
10	ELEMENTS SLOW BURNING 15A	1200
11	ELEMENTS SLOW BURNING 25A	1200
12	70 SQ MM 11KV 3C PILC (OR XLPE) CU CABLE IN MTS	1000
13	CORK SHEET 1.2MX1.2MX3MM	100
14	CORK SHEET 1.2MX1.2MX6.4MM	100
15	CORK SHEET 1.2MX1.2MX1.6MM	100
16	MANILA ROPES 24 MM (88KG) IN COILS	10
17	MANILA ROPES 16 MM (42KG) IN COILS	10
18	MANILA ROPES 12 MM (23KG) IN COILS	10
19	PREFORMED PT MAKE OFF FOR 7/8 SWG STAY WIRE	1500
20	PREFORMED PT MAKE OFF FOR 7/12 SWG STAY WIRE	1500
21	PREFORMED WRAP GUY GRIPS FOR 7/8 SWG STAY WIRE	2500
22	PREFORMED WRAP GUY GRIPS FOR 7/12 SWG STAY WIRE	1000
23	TURN BUCKLES 10"*5/8" EYE EACH END	500
24	TURN BUCKLES 10"*3/4" EYE EACH END	500
25	SILCA GEL IN 25KG PACK	50
26	25 KVA SINGLE PHASE 11KV/LV	150
27	50 KVA THREE PHASE 11KV/LV	100
28	100 KVA THREE PHASE 11KV/LV	50
29	315 KVA THREE PHASE 33KV/LV	5
30	SURGE ARRESTORS 11KV	1200
31	SURGE ARRESTORS 33KV	900
32	AUTORECLOSURES 11KV	30

THESE ITEMS WERE LEFT OUT BUT ALSO EQUALLY REQUIRED.

ITEM	DESCRIPTION	QUANTITY
33	JP FUSES 100A	10000
34	JP FUSES 200A	10000
35	JP FUSES 250A	10000

VEHICLES REQUIRED.

ITEM	DESCRIPTION	QUANTITY
36	4 x 4 Wheel drive	8
37	Self loading lorries	2
38	Street lighting lorry	1
39	Lorries	7
40	Spares for item 36, 37, 38 & 39 as one lot	1

SPECIFICATIONS OF SYSTEM MATERIALS

Item 1,2,3 & 4

J.P. Fuses.

a) 80 amps
b) 160 amps
c) 200 amps
d) 315 amps
e) 400 amps

Item 5
HRC Fuses 60/80A. to be used with Item 8.

Item 6
150 Amp four pole interior cutouts (interior only) each comprising a three phase assemblies one neutral connector block, 3 moulded fuse carriers with phase deviding barriers (one similar to lucy type MJW 3) would be preferred.

Item 7

300 Amp four pole interior cutouts (interior only) each comprising a three phase assemblies one neutral connector block, 3 moulded fuse carriers with phase deviding barriers.

Item 8
80A single pole fully insulated house service cut out complete with fuse holders, fuses and neutral block suitable for house service fuse link to BS 1361.

Item 9,10,11

HV Fuse elements Rating 5 Amps.
HV Fuse elements Rating 15 Amps.
HV Fuse elements Rating 25 Amps.
Slow burning fuse element intended for use with drop out fuse isolator below:
Isolator 11 KV drop out expulsion fuse with size 2 insulator (R 70) complete with expulsion fuse tubes ,fittings and conductor clamps(including LEL pull down fuse isolators converted to drop out).The isolators to be designed for and supplied with 18"(455mm) tubes.

Item 12
HV (11kV) 3 core PILC (or XLPE) Cu 70mmsq cable

Item 13
Cork Sheet 1.2M x 1.2M x 3MM
Suitable for making gaskets.
Item 14
Cork Sheet 1.2M x 1.2M x 6.4MM
Suitable for making gaskets.
Item 15
Cork Sheet 1.2M x 1.2M x 1.6MM
Suitable for making gaskets.

Items 16,17,& 18

a) Manilla rope 24mm diameter,three strand plain laid grade 2 to BS 2052/1977 with red and blue mark yarn interwoven with minimum breaking load of 4500 kg in coils of 88Kg.

b) Manilla rope 16mm diameter,three strand plain laid grade 2 to BS 2052/1977 with red and blue mark yarn interwoven with minimum breaking load of 3500 kg in ccils of 42Kg.

c) Manilla rope 12mm diameter,three strand plain laid grade 2 to BS 2052/1977 with red and blue mark yarn interwoven with minimum breaking load of 2500 kg in coils of 23Kg.

Item 19
Preformed Pole top Make Off For stay wire 7/8 swg.

Item 20
Preformed Pole top Make Off For stay wire 7/12 swg.

Item 21
Preformed wrap Guy grips for 7/8 swg stay wire.

Item 22
Preformed wrap Guy grips for 7/12 swg s

Item 23
Turn Buckles 10"x 5/8" Eye each end.

Item 24
Turn Buckles 10"x 3/4" Eye each end.

Item 25
Silica Gel in 25Kg Pack.
To be used in transfomer breather to eliminate moisture in the in coming air.

Item 26,27 & 28.
TRANSFORMERS

315KVA
200KVA
100KVA
50KVA

50 Hz,for pole mounting.vector group DYn 11 with off load tap changing Must have open bushings on both HV and LV sides ,completely filled with oil complying to BS 171/78 or IEC76. The voltage ratio is 11000/433 vol Tap change range from -5% to +5% in 2.5% increments.

Transformer 25 KVA....Single Phase.... 50 Hz,for pole mounting.With o Must have open bushings on both HV and LV sides ,completely filled with oil complying to BS 171/78 or IEC76.

Item 29
TRANSFORMERS

315KVA

As for items 35, 36 & 37 except for 33KV/lv.

Item 30
Surge arrester xca (Asea):
Rated at 10 KV,with norminal dischage current of 10KA,complete with mounting brackets suitable for Transformer mounting.

Surge arrester XBD 12 (Asea):
Rated at 10 KV,with norminal dischage current of 10KA,complete with mounting brackets suitable for Transformer mounting.

Item 31
Surge diveter type XBD 36(ASEA) rated 36kV with normal discharge current of 10 KA complete with brackets suitable for mounting on distribution transformers.

Item 32
11kV , ESR 400Amps 6kA 3 phase Autoreclosure each with "ON BOARD" microprocessor and spare card SF6 insulated unit, norminal system voltage rms 14.4 kV similar to those supplied by Reyrolle Switch Gear, protection O/L plug setting 25-225 % in 25 % increament ,E/F setting 1-9% in increment of one 1% time delay 0.25-60,sec. The unit should be filled with SF6 gas and carry line terminating clamp with single pole mounting brackets CT ratio 300/150/5A.

Item 33, 34 & 35.
As Item 1,2,3 & 4 except the ratings.

V E H I C L E S

Item 36.
4 Wheel Drive General purpose vehicle..e.g.Pajero, Land Cruiser etc.
Spare parts as recommended by manufacturers upto 10% of ex-factory price for the vehicles.
OR
Vehicles hard top cab 110" long wheel base with driving Dampers diesel/petrol engine water cooled RHD with hard top body.
Spare parts as recommended by manufacturers upto 10% of ex-factory price for land rovers.

Item 37.
Self Loading lorry 8-10 Ton

Self Loading with hydraulic lift capable of lifting loads of loads 3 tonne maximum.

Item 38.
Street Lighting Vehicles.

Intended for street lighting repairs capable of lifting a person to height of 25feet - 35feet.
Spare parts as recommended by manufacturers up to 10 1/2% of ex factory price for lorries.

Item 39.

Lorries 7 to 9 tons with winches load capacity 70-100KW, support body of 4.5 M3 capacity. Diesel engine water cooled RHD.
Spare parts as recommended by manufacturers up to 10 1/2% of ex factory price for 3 lorries.

Item 40
Spares for item 36,37, 38 & 39.

APPENDIX 8 COUNTRY DATA

Country Data

1. Basic Facts on the Republic of Uganda

1) Capital : Kampala

2) Land Area / Population

Land Area	:	197,000km^2
Population	:	17,214,000 (official estimate in 1990)
Population Density	:	87 persons/km^2 (official estimate in 1990)
Population Growth Rate	:	2.7% / year (1980 census)

3) Currency

1 US dollar = 522 shs (February, 1990)

4) Climate

There are 2 rainy seasons, i.e., the main rainy season from March to May and the minor rainy season from September to November, with frequent lightning.

5) Geography

Uganda is an inland country located at the equator and is some 800km distance from the nearest ocean (Indian Ocean). It is bordered by 5 countries, i.e., Sudan to the north, Zaire to the west, Rwanda and Tanzania to the south and Kenya to the east. Lake Victoria, the third largest lake in the world, is located in Uganda. 84% of the national land, excluding Lake Victoria, is highland with an elevation ranging from 900m to 1,500m which gently slopes towards the central area where Lake Kyoga is formed. Land with an elevation of less than 900m is located to the east of the Western Rift Valley and accounts for some 9% of the national land.

6) Geographical Location

Between 2°S Lat. and 4°N Lat. and between 28°E Long. and 35°E Long.

2. Socioeconomic Indices

1) GDP

Approximately 838 million dollars (1989, MPED Background to the Budget 1990 ~ 1991, exchange rate - 370 shs = 1 dollar).

2) GNP per Capita

Approximately 356 dollars (1987, APIC Report, May 1989).

3) Industries

Agriculture is the main industry, producing coffee, cotton and tea. A small amount of copper is mined.

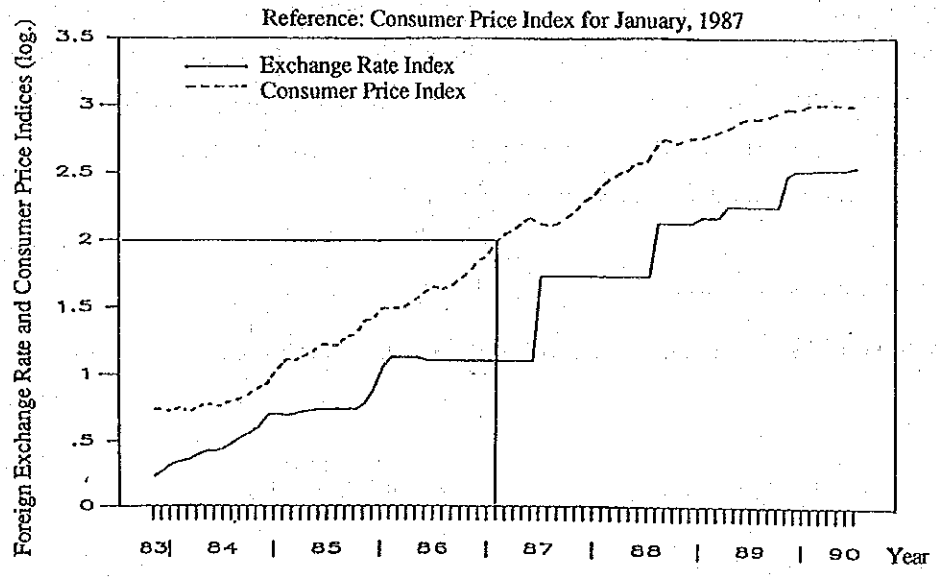
GDP Ratio by Industry (1989)

Industry	GDP Ratio (%)
Agriculture / Fisheries	50.4
Government Sector	13.9
Commerce	8.4
Services	6.4
Transport / Communications	3.6
Manufacturing	3.5
Others	13.8
Total	100.0

Source: APIC, May, 1989

4) Foreign Exchange Rate and Consumer Price Index

Foreign Exchange Rate and Consumer Price Index, 1983 ~ 1990



Source: MPED, Background to the Budget 1990 ~ 1991

5) Government Finance

(Unit: billion shs)

Item	1983	1984	1985	1986
Current				
Revenue	93	162	285	553
Expenditure	70	157	352	566
Investment	13	35	121	484
Total Balance	-18	-70	-137	-424
Funds Raised				
Home	23	54	94	406
Abroad	3	10	43	18

Source: APIC, May, 1989

3. Other Information

1) National Holidays (1990)

New Years' Day	January 1
NRM Victory	January 26
Good Friday	March 29
Easter Sunday	March 31
Easter Monday	April 1
Labor Day	May 1
Hero's Day	June 9
Independence Day	October 9
Christmas Day	December 25
Boxing Day	December 26

2) Office Hours

08:30 ~ 16:45
Lunchbreak: 12:45 ~ 14:00
Closed on Saturdays and Sundays

APPENDIX 9

ESTIMATED COST FOR THE WORK TO BE UNDERTAKEN BY UGANDAN SIDE

Estimated Cost for the Work to be Undertaken by Uganda Side

Breakdown of the cost for the work to be undertaken by Uganda Side is as follows:

1. Phase I

1-1 Relocation Cost of Station Transformer and Bus Lines

(1) Electrician	4 people x 10 days x 3.9 US$/day =	156 US$
(2) Labor	2 people x 10 days x 2.3 US$ / day =	46 US$
(3) Heavy duty machine for removal (50 ton crane)	1 set x 5 days x 800 US$/day =	4,000 US$
	(Sub-Total)	4,202 US$

1-2 Land Preparation Cost

(1) Excavation Work		
Queensway Substation	(16W x 20.2L x 0.2H) 64m^3 x 2.5 US$/m^3 =	160 US$
Motor Mart Switching Station	(10W x 13L x 0.2H) 26m^3 x 2.5 US$ / m^3 =	65 US$
(2) Filling Work		
Queensway Substation	(18W x 22L x 1.7H) 673m^3 x 2.42 US$/m^3 =	1,628 US$
Motor Mart Switching Station	(10W x 13L x 0.2H) 26m^3 x 2.42 US$ / m^3 =	62 US$
(3) Compaction Work		
Queensway Substation	(16W x 20.2L) 450m^2 x 0.65 US$/m^2 x 5 layer =	1,462 US$
Motor Mart Switching Station	(10W x 13L) 130m^2 x 0.65 US$ / m^2 =	84 US$
	(Sub-Total)	3,461 US$

1-3 Line Connection Cost to Existing Network

(1) 33KV Line	Electrician	6 points x 2 people x 3 days x 3.9 US$/day =	140 US$
(2) 11KV Line	Electrician	16 points x 2 people x 2 days x 3.9 US$/Day =	249 US$
(3) Common	Labor	4 people x 10 days x 2.3 US$/day =	92 US$
		(Sub-Total)	481 US$

1-4 Cost of Temporary Cabling Work between Existing Transformer and 33KV Transmission Line

(1) Electrician	12 points x 2 people x 3 days x 3.9 US$/Day =	280 US$
(2) Labor	4 people x 10 days x 2.3 US$/day =	92 US$
	(Sub-Total)	372 US$

1-5 OJT Trainee

(1) Electrician	10 people x 1 month x 78 US$/month =	780 US$

[Phase I Total 9,296 US$]

2. Phase II (None)