(3) Japanese Industrial Standards (JIS)
(4) Japanese Electrotechnical Commission (JEC)
(5) The Standard of Japan Electrical Manufacturers Association (JEM)
(6) Japan Cable Makers Association (JCS)
(7) Other Related Japanese Standards

4-3 Basic Plan

4-3-1 Site and Layout Plan

In preparing the Layout Plan, careful consideration will be directed to the following items in particular.

(1) The location at which the new facilities will be installed on site will be separated from existing transmission lines by a safe distance.
(2) Placement of facilities will guarantee sufficient maintenance space on the front and rear sides of the switchgear cubicles.
(3) To protect against flooding during the rainy season, the UEB will prepare measurements for water drainage on the new equipment sites to simplify land preparation of the site terrain with a view to equipment layout. Note that transformers, structures and foundations located on the planned site that are not required for the Project will be dismantled and transferred by the UEB prior to commencement of work by the Japanese side specified by the Project.
(4) Equipment layout will take into account the need to provide access for maintenance following the beginning of operations.

4-3-2 Facilities Plan

(1) Facility Composition and Common Specifications

Because the said substations are part of the transmission and distribution networks of the Kampala Suburban Area, the systems should, in principle, be coordinated with the new master distribution network plan prepared by the UEB.

(2) Substation Facility Plan

The Basic Plan for the substation facilities will be drafted based on the specifications compiled in Tables 4-1 to 4-7 as listed below.

<u>Phase I</u>

Kampala South Substation	See Table 4-1
Ntinda Substation	See Table 4-2
Kisugu Substation	See Table 4-3
Kawanda Substation	See Table 4-4

Phase II

Njeru Substation	See Table 4-5
Kisubi Substation	See Table 4-6
Kawala Substation	See Table 4-7

Table 4-1 Description of Kampala South Substation

1. 33kV switchgear cubicle (1/3) [Kampala South Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/3) [Kampala South Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	6 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (3/3) [Kampala South Substation]

Item	Q'ty	Specification
(3) 33kV Busbar and Coupling Switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Busbar	1 set	Material: Copper plate Rating: 2000A
2) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
8) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
9) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indication
10) Test terminal	1 set	
11) Control switches or push buttons for operation of circuit	1 set	
12) Position indicator	1 set	For circuit breaker
13) Annunciator	1 set	With two spare windows
(4) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3)

[Kampala South Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Kampala South Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	6 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 300/150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV busbar and coupling section switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Busbar	1 set	Material: Copper plate Rating: 2000A
2) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Grounding potential transformer	6 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Kampala South Substation]

Item	Q'ty	Specification
5) Over current relay with high speed operation (51H)	3 sets	
6) Over voltage ground relay (64V)	2 sets	
7) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
8) Voltmeter	2 sets	With volt selector switch Scale range: 0 to 15kV
9) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
10) Test terminal	1 set	
11) Control switches or push buttons for operation of circuit	1 set	
12) Position indicator	1 set	For circuit breaker
13) Annunciator	1 set	With two spare windows
(4) 11kV station transformer feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V–250V, Dyn 11, 150kVA
3) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 3 sets
4) Double throw type load break switch (for 1 cubicle set only)	1 set	
5) Position indicator	1 set	For load break switch
6) Annunciator	1 set	With two spare windows
7) Voltage detector	1 set	For neon voltage indication

3. Battery board [Kampala South Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling board [Kampala South Substation]

Item	Q'ty	Specification
SCADA interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Kampala South Substation]

Item	Specification
(1) 33/11kV Power Transformer × 2 sets	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 2 sets	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-2 Description of Ntinda Substation

1. 33kV switchgear cubicle (1/2) [Ntinda Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/2) [Ntinda Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 set	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary $33/\sqrt{3}$kV Secondary $110/\sqrt{3}$V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Ntinda Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Ntinda Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	4 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 300 – 150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal and treatment materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV station transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V-250V, Dyn 11, 150kVA
3) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3)

[Ntinda Substation]

Item	Q'ty	Specification
4) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 5 sets
5) Over voltage ground relay (64V)	1 set	
6) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
7) Position indicator	1 set	For load break switch
8) Annunciator	1 set	With two spare windows
9) Voltage detector	1 set	For neon voltage indication
10) Test terminal	1 set	

3. Battery board

[Ntinda Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle

[Ntinda Substation]

Item	Q'ty	Specification
SCADA interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Ntinda Substation]

Item	Specification
(1) 33/11kV Power Transformer × 1 set	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 1 set	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-3 Description of Kisugu Substation

1. 33kV switchgear cubicle (1/2) [Kisugu Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/2) [Kisugu Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 set	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Kisugu Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary 11/$\sqrt{3}$kV Secondary 110/$\sqrt{3}$V Tertiary 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600 – 300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cableterminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Kisugu Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	4 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 300/150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV station transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V – 250V, Dyn 11, 150kVA
3) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary $11/\sqrt{3}$kV Secondary $110/\sqrt{3}$V Tertiary 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Kisugu Substation]

Item	Q'ty	Specification
4) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 5 sets
5) Over voltage ground relay (64V)	1 set	
6) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
7) Position indicator	1 set	For load break switch
8) Annunciator	1 set	With two spare windows
9) Voltage detector	1 set	For neon voltage indication
10) Test terminal	1 set	

3. Battery board [Kisugu Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle [Kisugu Substation]

Item	Q'ty	Specification
SCADA interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Kisugu Substation]

Item	Specification
(1) 33/11kV Power Transformer × 1 set	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 1 set	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-4 Description of Kawanda Substation

1. 33kV switchgear cubicle (1/3) [Kawanda Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment materials	1 set	

1. 33kV switchgear cubicle (2/3) [Kawanda Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	4 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV busbar and coupling switchgear	1 set	Outdoor type, metal-enclosed switchgear cubicle
1) Busbar	1 set	Material: Copper plate Rating: 2000A
2) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)

1. 33kV switchgear cubicle (3/3) [Kawanda Substation]

Item	Q'ty	Specification
4) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: 33/√3kV Secondary: 110/√3 V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
8) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
9) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indication
10) Test terminal	1 set	
11) Control switches or push buttons for operation of circuit	1 set	
12) Position indicator	1 set	For circuit breaker
13) Annunciator	1 set	With two spare windows
(4) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary 33/√3kV Secondary 110/√3 V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Kawanda Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	1 set	Outdoor type, metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Kawanda Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	4 sets	Outdoor type, metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 300/150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV station transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V–250V, Dyn 11, 150kVA
3) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary $11/\sqrt{3}$kV Secondary $110/\sqrt{3}$ V Tertiary 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Kawanda Substation]

Item	Q'ty	Specification
4) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 5 sets
5) Over voltage ground relay (64V)	1 set	
6) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
7) Position indicator	1 set	For load break switch
8) Annunciator	1 set	With two spare windows
9) Voltage detector	1 set	For neon voltage indication
10) Test terminal	1 set	

3. Battery board [Kawanda Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type, metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle [Kawanda Substation]

Item	Q'ty	Specification
SCADA interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Kawanda Substation]

Item	Specification
(1) 33/11kV Power Transformer × 1 set	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 1 set	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-5 Description of Njeru Substation

1. 33kV switchgear cubicle (1/3) [Njeru Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	2 sets	Outdoor type, metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/3) [Njeru Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV busbar and coupling switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Busbar	1 set	Material: Copper plate Rating: 2000A
2) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)

1. 33kV switchgear cubicle (3/3) [Njeru Substation]

Item	Q'ty	Specification
4) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: 33/√3kV Secondary: 110/√3 V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
8) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
9) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indication
10) Test terminal	1 set	
11) Control switches or push buttons for operation of circuit	1 set	
12) Position indicator	1 set	For circuit breaker
13) Annunciator	1 set	With two spare windows
(4) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary 33/√3kV Secondary 110/√3 V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Njeru Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current Rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current Rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Njeru Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	6 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 300/150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV busbar and coupling section switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Busbar	1 set	Material: Copper plate Rating: 2000A
2) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Grounding potential transformer	6 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Njeru Substation]

Item	Q'ty	Specification
5) Over current relay with high speed operation (51H)	3 sets	
6) Over voltage ground relay (64V)	2 sets	
7) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
8) Voltmeter	2 sets	With volt selector switch Scale range: 0 to 15kV
9) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
10) Test terminal	1 set	
11) Control switches or push buttons for operation of circuit	1 set	
12) Position indicator	1 set	For circuit breaker
13) Annunciator	1 set	With two spare windows
(4) 11kV station transformer feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V – 250V, Dyn 11, 150kVA
3) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 3 sets
4) Double throw type load break switch (for 1 set of cubicle only)	1 set	
5) Position indicator	1 set	For load break switch
6) Annunciator	1 set	with two spare windows
7) Voltage detector	1 set	For neon voltage indication

3. Battery board [Njeru Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle [Njeru Substation]

Item	Q'ty	Specification
SCADA interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Njeru Substation]

Item	Specification
(1) 33/11kV Power Transformer × 2 sets	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 2 sets	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-6 Description of Kisubi Substation

1. 33kV switchgear cubicle (1/3) [Kisubi Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/3) [Kisubi Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 set	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Kisubi Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	For circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Kisubi Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	3 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV station transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V – 250V, Dyn 11, 100kVA
3) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Kisubi Substation]

Item	Q'ty	Specification
4) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF150AT x 1 set 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660v, 50AF/50AT x 5 sets
5) Over voltage ground relay (64V)	1 set	
6) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
7) Position indicator	1 set	For load break switch
8) Annunciator	1 set	With two spare windows
9) Voltage detector	1 set	For neon voltage indication
10) Test terminal	1 set	

3. Battery board [Kisubi Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle [Kisubi Substation]

Item	Q'ty	Specification
SCADA Interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Kisubi Substation]

Item	Specification
(1) 33/11kV Power Transformer × 1 set	
1) Rated capacity	2.5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	With cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (Open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 1 set	
1) Rated capacity	100kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

Table 4-7 Description of Kawala Substation

1. 33kV switchgear cubicle (1/2) [Kawala Substation]

Item	Q'ty	Specification
(1) 33kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 200/100A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer for differential relay (87)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 100A Secondary: 5A Burden: 40VA
5) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
6) Over current relay with high speed operation (51H)	3 sets	
7) Over current ground relay (51G)	1 set	
8) Over voltage ground relay (64V)	1 set	
9) Differential relay (87)	3 sets	
10) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
11) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 200/100A
12) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
13) Active power meter	1 set	
14) Reactive power meter	1 set	
15) Test terminal	1 set	
16) Control switches or push buttons for operation of circuit	1 set	
17) Position indicator	1 set	For circuit breaker
18) Annunciator	1 set	With two spare windows
19) Cable terminal treatment and materials	1 set	

1. 33kV switchgear cubicle (2/2) [Kawala Substation]

Item	Q'ty	Specification
(2) 33kV line feeder switchgear	2 sets	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 36kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 400/200A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Current transformer (for distance relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 200/100A Secondary: 5A Burden: 15VA
5) Voltage detector	1 set	For neon voltage indication
6) Over current relay with high speed operation (51H)	3 set	
7) Over current ground relay (51G)	1 set	
8) Auto-reclosing relay (79)	1 set	
9) Distance relay (21)	1 set	For short circuit, without HF interface module
10) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 400/200A
11) Kilowatt-hour meter	1 set	
12) Test terminal	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Control switches or push buttons for operation of circuit	1 set	
15) Position indicator	1 set	For circuit breaker
16) Annunciator	1 set	With two spare windows
17) Cable terminal treatment and materials	1 set	
(3) 33kV auxiliary switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $33/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Burden: 100VA
2) Voltmeter	1 set	With volt selector switch Scale range: 0 to 45kV
3) Test terminal	1 set	

2. 11kV switchgear cubicle (1/3) [Kawala Substation]

Item	Q'ty	Specification
(1) 11kV transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Current transformer for protection and measuring	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 600/300A Secondary: 5A Burden: 40VA (25 + 15VA)
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded Current rating: Primary: 300A Secondary: 5A Burden: 40VA
4) Grounding potential transformer with P.F.	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	2 sets	
7) Over voltage ground relay (64V)	1 set	
8) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 600/300A
9) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
10) Active power meter	1 set	
11) Reactive power meter	1 set	
12) Kilowatt-hour meter	1 set	
13) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
14) Test terminal	1 set	
15) Control switches or push buttons for operation of circuit	1 set	
16) Position indicator	1 set	for circuit breaker
17) Annunciator	1 set	With two spare windows
18) Cable terminal treatment and materials	1 set	

2. 11kV switchgear cubicle (2/3) [Kawala Substation]

Item	Q'ty	Specification
(2) 11kV line feeder switchgear	4 sets	Outdoor type, metal-enclosed switchgear cubicle
1) Circuit breaker	1 set	Type: Vacuum, draw-out Rating: 3 poles, 12kV, 630A, 25kA (Sym)
2) Earthing switch	1 set	Manual operation
3) Current transformer (for differential relay)	3 sets	Type: Indoor, resin-molded, 2 cores Current rating: Primary: 300/150A Secondary: 5A Burden: 40VA (25 + 15VA)
4) Voltage detector	1 set	For neon voltage indication
5) Over current relay with high speed operation (51H)	3 sets	
6) Over current ground relay (51G)	1 set	
7) Auto-reclosing relay (79)	1 set	
8) Trip circuit supervision relay	1 set	For indicating on-off position of circuit breaker and alarm indicator
9) Ammeter	1 set	With max. demand pointer and change-over switch Scale range: 0 to 300/150A
10) Kilowatt-hour meter	1 set	
11) Test terminal	1 set	
12) Control switches or push buttons for operation of circuit	1 set	
13) Position indicator	1 set	For circuit breaker
14) Annunciator	1 set	With two spare windows
15) Cable terminal treatment and materials	1 set	(Spare cubicle— only with terminal for 3C, CV 100mm^2 cable)
(3) 11kV station transformer feeder switchgear	1 set	Outdoor type metal-enclosed switchgear cubicle
1) Load break switch with HV fuses	1 set	Type: Indoor, manual operation Rating: 3 poles, 12kV, 200A HV fuse: 10A
2) Station transformer	1 set	Type: Oil-immersed, indoor Rating: 3 phase, 50Hz, 11kV/433V – 250V, Dyn 11, 150kVA
3) Grounding potential transformer	3 sets	Type: Indoor, resin-molded Voltage rating: Primary: $11/\sqrt{3}$kV Secondary: $110/\sqrt{3}$ V Tertiary: 110/3V Burden: 100VA

2. 11kV switchgear cubicle (3/3) [Kawala Substation]

Item	Q'ty	Specification
4) Molded case circuit breaker	1 set	Rating: 3 poles, 660V, 225AF/225AT x 1 set; 3 poles, 660V, 100AF/100AT x 2 sets; 3 poles, 660V, 50AF/50AT x 5 sets
5) Over voltage ground relay (64V)	1 set	
6) Voltmeter	1 set	With volt selector switch Scale range: 0 to 15kV
7) Position indicator	1 set	For load break switch
8) Annunciator	1 set	With two spare windows
9) Voltage detector	1 set	For neon voltage indication
10) Test terminal	1 set	

3. Battery board [Kawala Substation]

Item	Q'ty	Specification
Battery board	1 set	Outdoor type metal-enclosed cubicle Type: Nickel cadmium, alkaline Rating: 60AH, DC110V

4. SCADA interface marshaling cubicle [Kawala Substation]

Item	Q'ty	Specification
SCADA Interface marshaling cubicle	1 set	Outdoor type metal-enclosed cubicle

5. Transformer [Kawala Substation]

Item	Specification
(1) 33/11kV Power Transformer × 1 set	
1) Rated capacity	5MVA
2) No-load voltage ratio	33/11.55kV
3) Vector group symbol	Y, yn0, D11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	On-load tap changer on H.V. side
7) Tappings on H.V. side	17 taps (+6 taps 1.25% ~ -10 taps 1.25%)
8) Impedance voltage at principal tapping	6.7±10%
9) Temperature rise (Oil/Winding)	60/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 170kV 75kV
11) Terminals (Primary and Secondary)	with cable duct for both H.V. and L.V. sides
12) Accessories	• Current transformer for neutral circuit • Conservator (open type) • Oil level indicator • Buchholz relay • Dial type thermometer with alarm contact • Pressure relief vent • Handhole • Lifting lug for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Control cabinet • Other necessary accessories
(2) 11kV/433 – 250V Station Transformer × 1 set	
1) Rated capacity	150kVA
2) No-load voltage ratio	11kV/433 – 250V
3) Vector group symbol	Dyn11
4) Kind of cooling	ONAN
5) Rated frequency/phases	50Hz, 3-phase
6) Voltage adjustment	No-voltage tap-changer on H.V. side
7) Tappings on H.V. side	5 taps (±2.5, ±5.0%)
8) Impedance voltage at principal tapping	3.0% (Approx.)
9) Temperature rise (Oil/Winding)	55/65°C
10) Basic Impulse level (BIL) • Primary • Secondary	 75kV Not applicable
11) Terminals (Primary and Secondary)	Cover-mounted bushings
12) Accessories	• Oil level indicator with thermometer • Lifting lugs for complete transformer • Earthing terminal • Name plate • Base (without rollers) • Other necessary accessories

(3) Basic Design Drawings (Please refer to Appendix 9)

Phase I:

Kampala South Substation

BD-KPS-01	Oneline Diagram
BD-KPS-02	Outline of 33kV Outdoor Type Cubicle
BD-KPS-03	Outline of 11kV Outdoor Type Cubicle
BD-KPS-04	Equipment Layout Plan
BD-KPS-05	Arrangement of Cable Trench and Foundation
BD-KPS-06	Typical Arrangement of 33kV Line Connection

Ntinda Substation

BD-NTD-01	Oneline Diagram
BD-NTD-02	Outline of 33kV Outdoor Type Cubicle
BD-NTD-03	Outline of 11kV Outdoor Type Cubicle
BD-NTD-04	Equipment Layout Plan
BD-NTD-05	Arrangement of Cable Trench and Foundation

Kisugu Substation

BD-KSG-01	Oneline Diagram
BD-KSG-02	Outline of 33kV Outdoor Type Cubicle
BD-KSG-03	Outline of 11kV Outdoor Type Cubicle
BD-KSG-04	Equipment Layout Plan
BD-KSG-05	Arrangement of Cable Trench and Foundation
BD-KSG-06	Detail of 33kV Line Connection (33kV Cabe Method)

Kawanda Substation

BD-KWD-01	Oneline Diagram
BD-KWD-02	Outline of 33kV Outdoor Type Cubicle
BD-KWD-03	Outline of 11kV Outdoor Type Cubicle
BD-KWD-04	Equipment Layout Plan
BD-KWD-05	Arrangement of Cable Trench and Foundation

Phase II:

Njeru Substation

BD-NJR-01	Oneline Diagram
BD-NJR-02	Outline of 33kV Outdoor Type Cubicle
BD-NJR-03	Outline of 11kV Outdoor Type Cubicle
BD-NJR-04	Equipment Layout Plan
BD-NJR-05	Arrangement of Cable Trench and Foundation
BD-NJR-06	Detail of 33kV Line Connection

Kisubi Substation

BD-KSB-01	Oneline Diagram
BD-KSB-02	Outline of 33kV Outdoor Type Cubicle
BD-KSB-03	Outline of 11kV Outdoor Type Cubicle
BD-KSB-04	Equipment Layout Plan
BD-KSB-05	Arrangement of Cable Trench and Foundation

Kawala Substation

BD-KWL-01	Oneline Diagram
BD-KWL-02	Outline of 33kV Outdoor Type Cubicle
BD-KWL-03	Outline of 11kV Outdoor Type Cubicle
BD-KWL-04	Equipment Layout Plan
BD-KWL-05	Arrangement of Cable Trench and Foundation

4-3-3 Equipment and Materials Procurement Plan

(1) Equipment and Material for MV and LV Distribution Network

The items, specifications and quantities of the equipment and materials to be procured for the MV and LV distribution network based on the study results (see 3-2-5) and the design policy (see 4-1) are shown in Table 4-8.

Table 4-8 Equipment and Material for MV and LV Distribution Network to be Procured under the Project

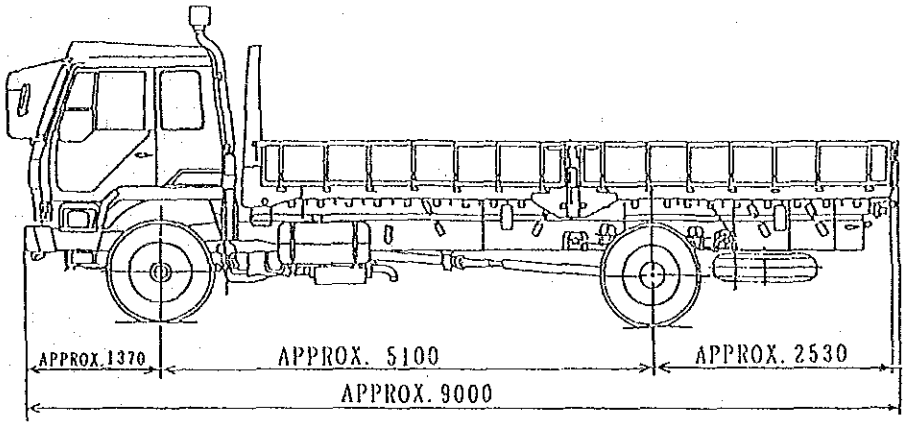
No.	Item	Units	Procurement Quantity		
			Phase I	Phase II	Total
1	Distribution transformer (pole-mounted type) Single-phase 11kV/250V 25kVA	Units	10	—	10
2	Distribution transformer (pole-mounted type) Three-phase 11kV/433V 100kVA	Units	11	15	26
3	Distribution transformer (pole-mounted type) Three-phase 11kV/433V 200kVA	Units	5	14	19
4	Distribution transformer (pole-mounted type) Three-phase 11kV/433V 315kVA	Units	32	15	47
5	Distribution transformer (ground mounted type) Three-phase 11kV/433V 500kVA	Units	5	6	11
6	Distribution transformer (pole-mounted type) Three-phase 11kV/433V 500kVA	Units	—	2	2
7	11kV Surge arrestor (for distribution transformer use)	Units	180	156	336
8	Aluminum-alloy standard conductor (AAAC) 150m^2 (for 33kV transmission line)	km	42	—	42
9	Disk insulator (for 33kV transmission line)	Pieces	800	—	800
10	Pin insulator (for 33kV transmission line)	Pieces	400	—	400

(2) Maintenance Vehicles for Distribution Network

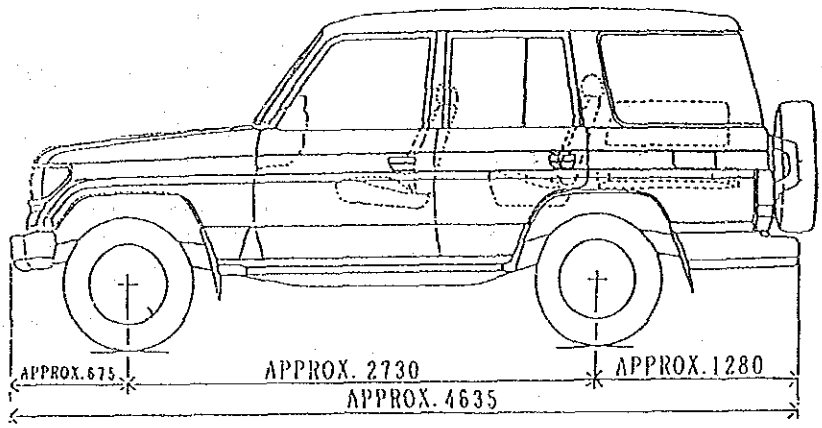
In accordance with the study results of the requested equipment and materials, etc. (see 3-2-5), the maintenance vehicles shown in Table 4-9 will be procured under the Project. The subject vehicles are illustrated in Fig. 4-1.

Table 4-9 Maintenance Vehicles for Distribution Network to be Procured under the Project

Item	Specifications	Procurement Quantity		
		Phase I	Phase II	Total
Lorry	Diesel engine Loading capacity: 7 tons Spatial capacity: 4.5m^3	—	2	2
4 wheel drive	Diesel engine (around 2,500cc) 9 seats	3	2	5
Spare parts	2 years' supply	1 set	1 set	2 sets



Lorry



4 Wheel drive vehicle

Fig. 4-1 Outline of Vehicles for the Project

(3) Auxiliary Equipment and Materials Related to the Substations

In accordance with the study results of the requested facilities [see 3-2-5 (4)], the auxiliary equipment and materials related to the substations which are listed in Table 4-10 will be procured under the Project.

Table 4-10 Auxiliary Equipment and Materials related to the Stations to be Procured under the Project

Item	Procurement Quantity		
	Phase I	Phase II	Total
1. 11kV Cables to connect existing 11kV distribution line with new distribution facilities (11kV armored cable, 3 cores, 100mm^2)	1,500m	950m	2,450m
2. Terminals for the above 11kV cable 1) 3 core, 100mm2 (Indoor use) 2) 3 core, 100mm2 (Outdoor use)	 13 sets 13 sets	 9 sets 9 sets	 22 sets 22 sets
3. 11kV Surge Arrestor (for distribution line)	39 sets	27 sets	66 sets
4. Aluminum-alloy stranded conductor to connect new 33kV cable with existing transmission line (AAAC 150mm^2)	700m	1100m	1800m
5. 33kV cables to connect future transmission line in Kawanda Substation (Kampala North and Bombo Substations) (33kV armored cable, triplex, 185mm^2)	50m	—	50m
6. Terminals for the above 33kV cable 1) single core, 185mm^2 (Indoor use) 2) single core, 185mm^2 (Outdoor use)	 6 sets 6 sets	 — —	 6 sets 6 sets
7. Outdoor type surge arrestor for above facilities (30kV, 10kA, Gapless type, with supporting structures)	6 units	—	6 units
8. 2 years' supply of spare parts for the new substation facilities	1 set	1 set	2 sets

4-4 Implementation Plan

4-4-1 Construction Condition

The Project will be implemented within the framework of Japan's Grant Aid. Prior to implementation, the Project must be approved by both governments and the Exchange of Notes (E/N) will be concluded. Following the conclusion of E/N, the Government of Uganda will make a contract with a Japanese consulting firm to conduct the detailed design work. Upon completion of the detailed design documents, a Japanese contractor selected through a tender procedure assisted by the consultant and the Government of Uganda will commence the construction of the facilities and the procurement of the equipment and materials. Particular attention must be paid to the following in the implementation of the Project.

(1) Execution Agency

The UEB which is responsible for all services in the power sector in Uganda will be responsible for the implementation of the Project (see 2-1-1-1). At the UEB, the Development, Distribution and Administration Divisions will be directly responsible for the smooth progress of the Project implementation under the leadership of the Deputy Managing Director in charge of technical aspects. The Government of Uganda is required to appoint a full-time official to coordinate the Project implementation by maintaining close contact and consulting with the Japanese consultant and contractor.

(2) Consultant

For the construction of the facilities and the procurement of the equipment and materials under the Project, the Japanese consulting firm will conclude a consultancy agreement with the Government of Uganda, conduct the detailed design for the construction and procurement and conduct the supervision and control of the construction work. The consulting firm will also prepare the tender documents and conduct the tender procedure on behalf of the Government of Uganda.

(3) Contractor

In accordance with Japan's Grant Aid, the Japanese contractor to be selected by public tender will construct the facilities and procure the necessary equipment and materials. It is also considered necessary for the contractor to provide such after-service as the supply of spare parts and the repair of out-of-service equipment even after the completion of the construction work. Therefore, the contractor should give due consideration to communication with and coordination between the Ugandan representatives and the Japanese counterparts following the completion of the construction work.

(4) Necessity for Dispatch of Engineers

The construction work under the Project requires engineers experienced in the configuration and functions of the facilities for the Project. The manufacturer of the substation facilities in Japan will require the dispatch of engineers experienced in the construction and other aspects of the required work to Uganda in view of the difficulty of securing such engineers in Uganda.

(5) Specific Points to Note for Construction Work

The following points must be noted for the construction of the subject substation facilities taking into consideration that long distance of transportation will be required, some work will be conducted alongside the operating substation and the Project will be implemented under the Grant Aid.

1) Particular care is required for packaging and the transportation time as the main equipment and materials for the Project will be taken to the sites by long land transportation (some 1,100k13) from Kilindini Port (Mombasa's new port).
2) The construction method and machinery to be used should be carefully selected to avoid accidental damage to the existing facilities.
3) The temporary facilities and stockyard required for the construction work should be located so as not to damage the existing facilities.
4) The construction schedule of the Japanese side must be coordinated with the schedules of the work to be conducted by the Ugandan side through prior consultations with the UEB, and must be adhered to.
5) All the work at the substations must be smoothly conducted to minimize the installation work period and to adhere to the planned implementation schedule.

4-4-2 Implementaion Method

(1) Construction Industry in Uganda

1) Workers capable of conducting the foundation and other work can be employed locally.
2) Engineers capable of conducting the installation and adjustment, etc., of the anticipated substation facilities for the Project cannot be locally employed.
3) Except for some special items, it is believed that the construction machinery and general tools can be locally supplied.
4) The use of Kilindini Port in Kenya for the unloading of the equipment and materials is advisable in view of the fact that it is Kenya's largest unloading port. with the large unloading facilities available at the Port, difficulties are not anticipated in handling the Project cargo.
5) In regard to the inland transportation of some 1,100km from Kilindini Port to the Project sites, the road is in generally good condition except for some short sections. This is currently the main route for the supply of goods to Uganda and is generally adequate.

(2) Points to Note for Construction Work

1) Kampala has two rainy seasons, from March to May and from September to November, during which the monthly rainfall tends to exceed 100mm, indicating that particular attention should be paid to the installation of heavy equipment.
2) The installation of the substation facilities should immediately follow the completion of the land preparation and foundation work.

3) The construction schedule at the substations must be coordinated with the land preparation work to be conducted by the UEB and the foundation work (concrete placing) to be conducted by the contractor.
4) As the planned site for the new facility is adjacent to a general-use road, particular care should be taken to avoid causing injury to any third party due to construction work on the site.

4-4-3 Construction and Supervisory Plan

In accordance with the general policy of Japan's Grant Aid and the main objectives of the basic design, the consultant will organize a consistent project team to conduct the detailed design and supervisory work for the smooth implementation of the work. At the supervisory stage, the consultant will dispatch technically qualified field supervisory personnel to the sites for liaison and the provision of guidance on the execution of the work. The field supervisory personnel will be dispatched in accordance with the following schedule.

Phase I

First Half (approx. 6.5 months)	:	1 civil engineer (supervision of foundation work for main equipment)
Second Half (approx. 6 months)	:	1 electrical engineer (supervision of equipment installation work)

Phase II

First Half (approx. 6.5 months)	:	1 civil engineer (supervision of foundation work for main equipment)
Second Half (approx. 6.5 months)	:	1 electrical engineer (supervision of equipment installation work)

In addition, it will be necessary for the consultant to dispatch engineers, each of which is responsible for a particular field of design, for a short period of time as required in accordance with the progress of the work to supervise work implementation and to conduct inspections.

(1) Basic Principles for Supervision of Construction Work

The consultant is required to conduct appropriate supervision throughout the work period in view of the safe execution of the construction work and meeting all the requirements within the set construction period on the basis of the following principles.

1) Management of Work Progress

1) The manufacture and delivery of the equipment and materials and work progress will be controlled by continual checks on the work progress against the original plan.
2) The schedule for each type of work will be controlled on a monthly, weekly, and daily basis and guidance will be provided to the contractor to meet the agreed work schedule.

2) Quality Control

1) The quality of the equipment and materials will be controlled by checking these against the specifications given in the detailed design documents.
2) Quality testing, accuracy inspections, construction method inspections, and various performance tests regarding foundation construction, installation, piping, wiring and connection work, etc., undertaken on the sites will be conducted.

3) Safety Control

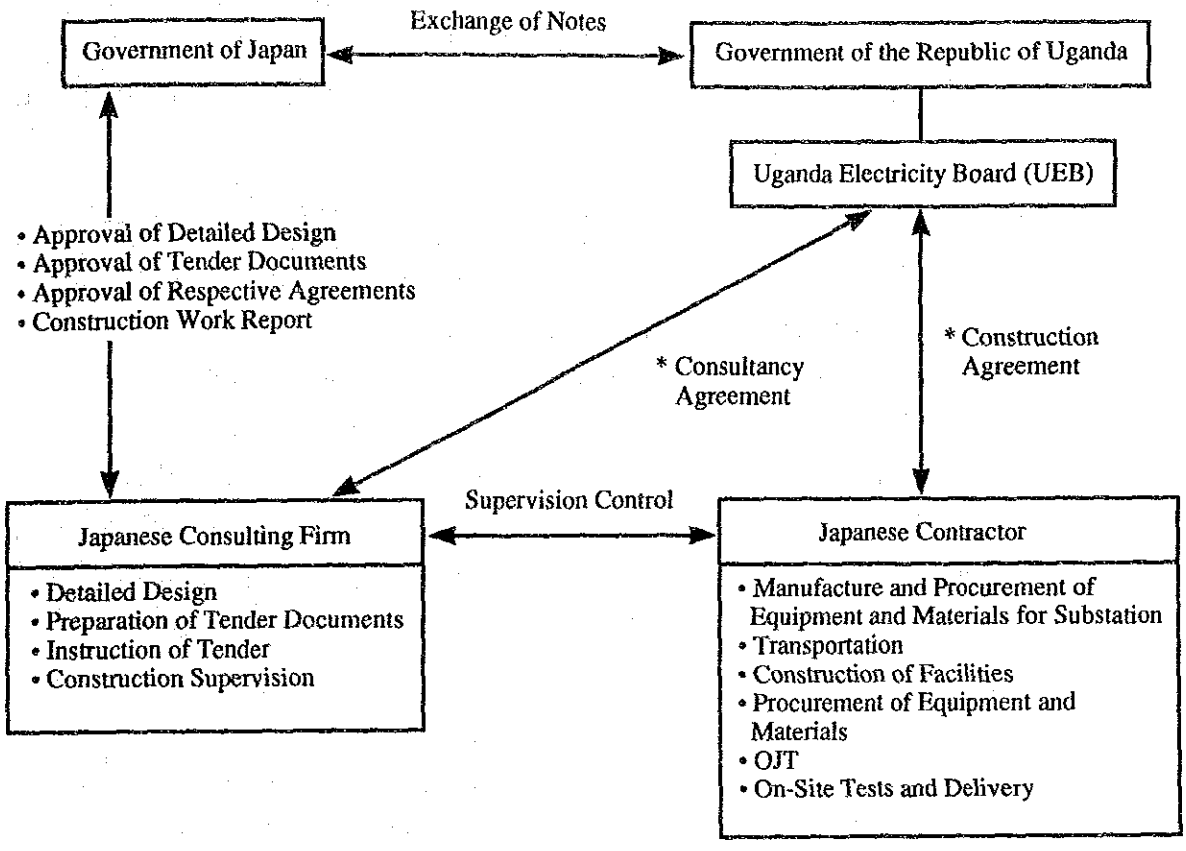
1) Guidance will be provided to the contractor to increase the safety awareness of all workers to prevent accidents while foreman class workers will be trained to prevent any safety hazards involved in the work.
2) Continual checks of the operation of the existing facilities will be ensured to avoid electrification accidents.
3) Every effort will be made to prevent accidents by continual checks of the conditions of the construction machinery, including lorry-loaded cranes.
4) When transport vehicles and construction machinery, etc., travel on the construction sites, reduced driving speeds will be strictly adhered to and every precaution taken to prevent traffic accidents that can cause personal injury and/or damage to the existing facilities.

4) Environmental Protection

When work is being performed, care will be taken to preserve the environment of the surrounding residents with respect to noise, vibration, and water quality, and environmental protection measures will be taken, as required.

(2) General Relationships During Supervisory Control

The following figure shows the general relationship of the work supervision system and related organizations during the supervision period.



* Both the consultancy and construciton agreements are subject to verification by the Government of Japan.

Fig. 4-2 Processes of Project Implementation

(3) Work Supervisors

In order for the contractor to complete the construction of the facilities conforming to the specifications given in the detailed design documents within the set construction period, work supervisors with the ability to smoothly manage joint work with local contractors and to provide adequate technical guidance to such local contractors, are required. In addition, it is desirable that these supervisors have experience in similar projects in order to guarantee a high quality work.

Based on the scale and contents of the facilities to be constructed under Phase I and II of the Project, the contractor stationed at the sites may require the following full-time supervisors:

For both Phase I and Phase II work

Site Manager	: 1	To supervise the entire work
Testing Engineer	: 1	To perform testing of electrical equipment
Electrical Engineer	: 4	To supervise the installation of electrical equipment and work progress
Civil Engineer	: 1	To supervise the civil work and work progress

4-4-4 Procurement Plan

(1) Sources of Equipment and Materials

With the exception of aggregate, cobblestones, cement, and fuel oil, the equipment and materials for the Project will be supplied from Japan in view of the unavailability of such equipment and materials in Uganda. While Uganda imports some of these items, the existing import arrangements cannot be relied upon in view of difficulties in meeting the delivery or quality requirements for the Project.

As a result of a comparative study on industrial standards, specifications, quality, production, supply stability, lead time and prices, the equipment and materials for the Project will be procured from the sources listed in Table 4-7 below.

In view of the fact that the Project is being performed under the Grant Aid Program of Japan, the need for manufacturing to keep abreast of work progress, and the fact that Japanese manufacturers are able to meet delivery dates and appropriately schedule work, Japan-based procurement of equipment for the outdoor closed-type distribution cubicles and power transformers, and the facilities and materials for the distribution network is deemed reasonable in the performance of the Project.

Table 4-11 Sources of Equipment and Materials

Source	Equipment and Materials
Uganda	Aggregate (gravel, rubble), cobblestones, cement, fuel oil
Japan	• 33kV outdoor type cubicle • 11kV outdoor type cubicle • Power transformers • DC battery board • Maintenance vehicles • Spare parts and special tools for substation use • Distribution transformers • Distribution materials (insulator, aluminum conductor) • Electriccable and conduit pipe • Steel • Paint

(2) Transportation Method

Adequate packaging must be provided for cargo to withstand the transportation conditions in terms of the port conditions in Kenya, long land transportation distance, total transportation period, and the Project sites. Trailers, etc., will be used for the some 1,100km land transportation of the cargo from the unloading port in Kenya to the Project sites.

4-4-5 Implementation Schedule

(1) Outline

In the event of the Project being implemented as Japan's Grant Aid, the facilities will be constructed and the equipment and materials procured in the following three stages following the conclusion of the Exchange of Notes (E/N) by the two governments: 1) preparation of detailed design documents; 2) tender and agreement on construction work; and 3) execution of construction work. These processes are illustrated in Fig. 4-3.

1) Detailed Design Work

Following the conclusion of the E/N, the Japanese consultant will immediately conclude a consultancy agreement with the Government of Uganda and commence the detailed design work.

Based on the confirmed results of the basic and detailed design surveys, the consultant will prepare the tender documents, including the tender specifications and detailed design drawings. The consultant will hold thorough discussions with the responsible organizations in Uganda at both the initial and final stages of the detailed design and proceed with the tender process upon receipt of approval of the prepared documents and drawings, etc., by the Ugandan side.

three months for Phase I construction work and three months for Phase II construction work.

2) Awarding of Contract

Acting for the Ugandan representatives, the consultant will announce the tender, accept applications, evaluate the tenderers in terms of the necessary qualifications, hold briefings on the tender and distribute the tender documents. After allowing a certain period of time for the preparation of the tenders, the consultant will then accept the tenders, promptly examine these and assist in the quick conclusion of a construction agreement between the Government of Uganda and a Japanese contractor.

The tender of the applicants will be opened in the presence of all the parties concerned. The applicant with the lowest price will be selected as the successful bidder if the contents of the tender are found to be appropriate and will conclude a construction agreement with the Government of Uganda.

The period from the commencement of the tender process to the conclusion of the contract is expected to be about 1.5 months for both phases.

3) Construction Work and Procurement of Equipment and Materials

Following the signing of the construction agreement, the contractor will commence work upon verification by the Government of Japan. Judging from the scale of the Project and the contents of the facilities and if the preparatory work for which the Uganda representatives are responsible is smoothly conducted, the construction work and procurement of equipment and materials are expected to be completed in 12 months for Phase I, and 12 months for Phase II.

The consultant will hold discussions with the contractor prior to the commencement of the work, provide guidance and instructions to the contractor on the transportation of the equipment and materials to the sites, construction methods and construction schedule, conduct process and quality control and ensure that all the work is completed within the period set forth in the E/N.

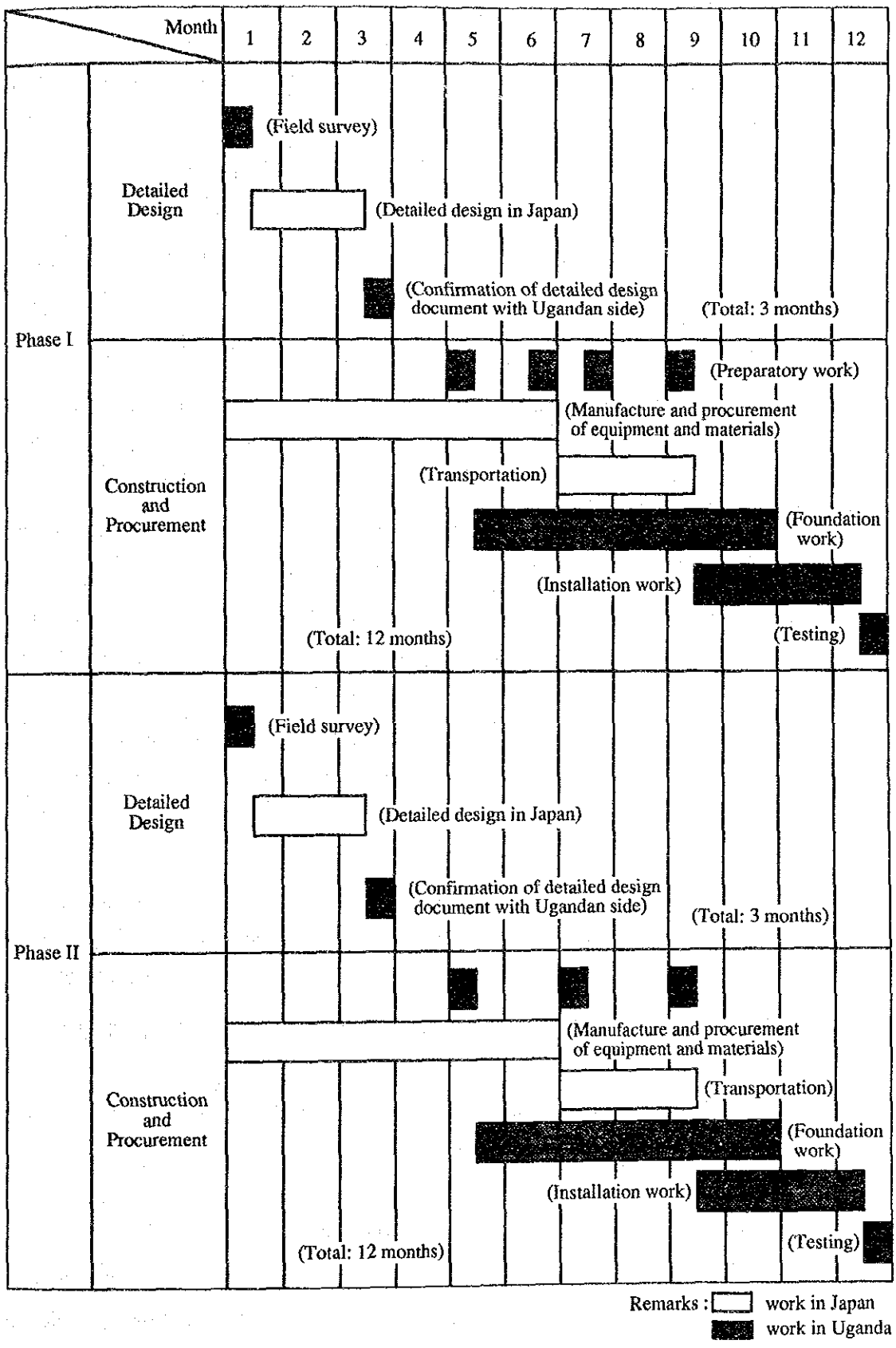


Fig. 4-3 Project Implementation Schedule

4-4-6 Scope of Work

(1) Work Assignment

The Governments of Japan and Uganda will undertake the following work to complete the Project.

1) Work to be Undertaken by the Government of Japan

a) To undertake substation construction work.

b) To procure equipment and materials for MV and LV distribution networks.

c) To procure maintenance vehicles.

2) Work to be Undertaken by the Government of Uganda

a) To secure and provide cleared, embanked and leveled land as well as access road for the Project prior to the commencement of the construction by the Japanese side.

b) To provide the land for temporary site offices, warehouses and stock yards in the sites during the implementation period.

c) To ensure speedy unloading, internal transportation, tax exemption, custom clearance of the goods for the Project at the port and/or airport of disembarkation, and internal transportation in the Republic of Uganda.

d) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Uganda and stay therein for the performance of their work.

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Uganda with respect to the supply of the products and services under the verified contracts.

f) To bear commissions to a Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

g) To bear all the expenses, other than those to be borne by the Grant Aid necessary for the execution of the Project.

h) To provide proper arrangements for the construction, such as water supply electricity, drainage, etc., if necessary.

i) To assign exclusive-counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction when inspection are carried out.

j) To take necessary measures and responsibility for the stoppage of electricity during a construction period, when it is necessary.

k) To construct and connect the cables for incoming and outgoing feeders for substations which will be constructed under the Project.

l) To dismantle and remove the existing equipment and facilities not to be used for the Project in the existing Substations.

m) To provide a bench mark at the sites.

n) To provide site drainage system and other facilities including outdoor lighting system, fire fighting system, telecommunication system, etc., at the sites, if necessary.

o) To provide necessary data and information for the detailed design of the Project.

p) To take necessary measures to expedite the approval for executions of the Project by the Government of Uganda.

q) To control traffic during the inland transportation of the facilities of the Project, if necessary.

r) To provide the disposal places of the surplus soil during the construction period.

s) To secure the approval for access to public and private land for the Project.

t) To secure the approval for protection works of the existing facilities, if necessary.

u) To provide relay tap setting work regarding the transmission and distribution lines and study of the transmission and distribution network including relay protection coordination, short circuit calculation, etc.

(2) Cost to be borne by the Government of Uganda

Total Cost Estimate: US$76,143.82 (about ¥8.8 Million)
(For details, see Appendix 9)

Phase I:

1)	Kampala South Substation	4,561.47 US$
2)	Ntinda Substation	35,431.55 US$
3)	Kisugu Substation	6,606.37 US$
4)	Kawanda Substation	7,160.28 US$
Phase I total		53,759.67 US$

Phase II:

1)	Njeru Substation	5,911.15 US$
2)	Kisubi Substation	5,290.30 US$
3)	Kawala Substation	11,182.70 US$
Phase II total		22,384.15 US$

In addition, the following expenses will be incurred:

1) Commission for banking arrangements : 0.01% of E/N value

2) Advising commission of authorization to pay (A/P): Approx. ¥3000 for each time A/P is issued

Estimate Conditions

1) Estimate Time : July, 1993

2) Exchange Rate : 1 US$ = 1,193 Ush (Average 180-day TTB rate from January to June 1993).
1 US$ = ¥116.53 (Average 180-day TTS rate from January to June 1993)

3) Construction Period : The Project shall be executed in two phases as shown in Fig. 4-3.

4) Others : The Project shall be executed under the regulation of Japan's Grant Aid.

CHAPTER 5 PROJECT EVALUATION AND CONCLUSIONS

CHAPTER 5 PROJECT EVALUATION AND CONCLUSIONS

5-1 Project Effects

The Project is expected to have the direct effect of providing a stable power supply through the construction of new substations and the installation of new distribution equipment including distribution transformers. An indirect effect is that, by definition, a stable power supply leads to the stabilization of daily activities, and invigorates commerce and industry. Table 5-1 shows effects of the implementation of the Project.

Table 5-1 Current Distribution Facilities Condition and Effects of Project Implementation (1/2)

Item	Current Conditions and Problems	Measures Taken under the Project	Effects of the Project and Degree of Improvement
① Construction or rehabilitation of 7 distribution substations in Kampala suburban areas	1. The condition of the power supply is unstable for two reasons. First, since the power transmission and distribution network in Kampala suburban area was built about 40 years ago, it is showing significant signs of aging, and second, maintenance was neglected during the civil war. 2. Projects and construction of private factories are underway in suburban areas as part of national rehabilitation and development activities. However, the condition of the power supply hinders this development.	Three distribution substations in the Kampala suburban area will be rehabilitated and four distribution substations will be newly constructed in areas which are currently under development.	1. A stable power supply will be provided to areas supplied power by the distribution substations of the Project. In addition, new factories and households will be supplied with power. 2. Construction of the distribution substations under the Project will ease the burden on existing substations, which are forced by circumstances to supply power from a long distance away, thus, a stable power supply will be secured for the entire power grid 3. A stable power supply will improve the life of the citizens and eliminate obstructions to production caused by power failures in factories. Also, a new supply of power will aid in the development of other national projects, thus contributing to the revitalization of society and the economy and the improvement of people's lives.
② Procurement of equipment and materials for distribution network	The electrification ratio in Kampala currently stands at around 33%; that in suburban areas is much lower and very few people and factories have access to the benefits of electricity. Such a situation hinders social and economic activities and the improvement of civil life.	Equipment and materials required for power distribution will be provided to designated areas for each of the substations in the Project to accomplish initiation of operation of the substations.	1. It will be possible to directly meet new demands for power, thus the electrification ratio will rise to about 43%. It will also improve the lives of the citizens, preserve forest resources, and enable the development of industry — the key to the revival of Uganda. 2. The Second and Third Power Projects currently underway with the cooperation of the World Bank, etc., are designed to reinforce and transform the fundamental system underlying current power generation capabilities and power sources. Since the distribution facilities of the Project are to directly meet demand as a subsystem of the above fundamental power system, it will be possible to create a complete power system through the installation of distribution facilities under the Project. This will directly increase the income derived through sale of electricity. Therefore, it will be possible to recover the capital invested in the Second and Third Projects.

Table 5-1 Current Distribution Facilities Conditions and Effects of Project Implementation (2/2)

Item	Current Conditions and Problems	Measures Instituted under the Project	Effects of the Project and Degree of Improvement
③ Procurement of maintenance vehicle for distribution network	1. Superannuation of maintenance vehicles owned by the UEB District Offices, which handles maintenance and control of the Kampala distribution network, leads to frequent failures in hydraulic systems, meters, etc., due to a shortage of spare parts and hard use caused, in part, because of a resultant shortage of vehicles. Proper maintenance cannot be performed consistently under these circumstances. 2. Shortages in the number of vehicles available prevents any kind of quick response when an accident occurs in the distribution network and containment and isolation of the accident cannot be performed properly. There are consequently much greater attendant risks to use of the distribution network under such conditions.	It will be required to procure the following vehicles to ensure that safe and appropriate maintenance of the distribution network can be performed • Vehicles used to carry equipment and materials and transport personnel (truck) • Vehicles used to inspect distribution network (4-wheel drive)	1. The mobility required to properly maintain the distribution network will be secured, thus allowing for quick, responsive maintenance. 2. It will be possible to contain and isolate accidents in the distribution network, thus a stable power supply and improved service can be expected. 3. Proper management of maintenance vehicles will provide appropriate cycling preventive inspection, thus the reliability and safety of the power supply can be secured.

5-2 Conclusions

The supply of power in the suburbs of Kampala is at the mercy of frequent power failures due to accidents and facilities breakdowns caused by a general deterioration of the existing facilities and a shortage of transformer capacity, and planned power cuts due to a shortage of transformer capacity as explained earlier (see 2-3-4). Moreover, as the current system does not have the ability to meet new demand, the execution of national projects, overall quality of life in the suburbs, and industrial activities, etc., are very seriously hindered.

Under these conditions, Uganda has drawn up plans for the Second and Third Power Projects and is urgently taking measures to improve the supply of power. However, these projects are intended to improve the fundamental power system, therefore the building of subsystems, i.e., the power distribution network, is still inadequate. The Project is positioned in such a way that it reinforces the subsystem of these very same power projects. Through the implementation of the Project, the completion of power supply facilities will make it possible to secure stable power operation in the metropolitan area. Furthermore, the implementation of the Project, including the construction of concerned substations, can be expected to be a source of encouragement for other national projects, to improve the lives of those living in metropolitan areas of Uganda, and to lead to the revitalization of social and economic activities. In addition, the scale of the Project matches the facility structure and major specifications indicated in the Second Power Project (the Power Distribution Network Plan in Kampala) in terms of the technical aspects, including facility capacities and certain financial and maintenance aspects such as personnel expenses. Also, handling of the concerned facilities will take place under the current maintenance and control structure of the UEB. The Project can therefore be determined to be appropriate as a subject for Grant Aid.

Furthermore, as explained earlier (see 2-1-2-1), the Project will facilitate the plan to promote the electrification of suburban and rural areas which is the basic policy of the National Rehabilitation Development Plan (1992/93 ~ 1994/95) defined by the power sector.

Moreover, bearing in mind that the concerned substation facilities will cover supply of power to densely populated housing areas and small/medium industrial areas in the metropolitan area, it should be understood that the direct effect to 198,000 peoples (estimated service population in 1995) and the in-direct effect to the approximately 1,240,000 residents of the metropolitan area will be significant in terms of encouraging economic and industrial growth.

In view of the above, it is determined that the implementation of the Project by Grant Aid by the Government of Japan is very meaningful and highly appropriate.

5-3 Recommendations

It is recommended that the Ugandan representatives take the following measures to maintain the appropriate operation of the new facilities over a long period of time, as the Project plays an important part in improving the power supply system in Uganda in order to secure a stable power supply.

(1) The Ugandan representatives should review the overall operation plan for the transmission and distribution networks, including the new facilities to be installed under the Project, and should assist with the establishment of a highly reliable power supply system by the preparation of a concrete operation and maintenance plan for the new facilities.

(2) The Ugandan representatives should nominate engineers to be responsible for the maintenance of the new facilities to achieve the effective implementation and successful completion of the Project, and these engineers should undergo OJT to be provided under the Project.

(3) The Ugandan engineers selected to undergo OJT should learn operation and maintenance techniques from the Japanese engineers of the contractor and should continue to improve their technical expertise on their own initiative following the completion of the Project.

(4) The Ugandan engineers selected to undergo OJT should transfer their newly acquired knowledge and techniques on operation and maintenance to their colleagues who have not undergone such OJT in order to improve the general technical level of Ugandan engineers.

(5) The Ugandan engineers selected to go to Japan to take part in the training for maintenance/control techniques of the concerned substations should make an effort to master the appropriate techniques and should continue to guide Ugandan engineers after initiation of the operation of substations covered by the Project.

APPENDIX

APPENDIX 1 MEMBER LIST OF SURVEY TEAM

List of Study Team Members (Basic Design Study)

Name	Assignment	Position
Mr. Yasuhiro Morimoto	Team Leader	Grand Aid Division of Economic Cooperation Bureau, the Ministry of Foreign Affairs
Mr. Tadao Okabe	Power Planner	Yachiyo Engineering Co., Ltd.
Mr. Noritsune Chiba	Power Distribution Facility Planner	Yachiyo Engineering Co., Ltd.
Mr. Masatsugu Komiya	Substation Facility Planner	Yachiyo Engineering Co., Ltd.

List of Study Team Members (Draft Final Explanation Team)

Name	Assignment	Position
Ms. Eri Honda	Team Leader	Planning Division of Planning Department, JICA
Mr. Tadao Okabe	Power Planner	Yachiyo Engineering Co., Ltd.
Mr. Masatsugu Komiya	Substation Facility Planner	Yachiyo Engineering Co., Ltd.

APPENDIX 2 SURVEY SCHEDULE

1. Field Survey Schedule (Basic Design Study)

No.	Date	Day of Week	Weather	Place of Stay	Schedule	Activities
1	06.06	Sun.	Fine	London	Lv. Narita at 13:55 on BA008 Ar. London at18:25	Departure of Basic Design Study Team (Consultant Team) from Tokyo.
2	06.07	Mon.	Fine	In flight	Lv. London at 17:00 on BA069	Travel.
3	06.08	Tue.	Fine	Kampala	Arrival in Entebbe at 05:45.	Arrival of Study Team in Uganda. Courtesy visit to Uganda Electricity Board (UEB). Explanation and discussion of Inception Report, Grant Aid program, Field Survey Schedule and Minutes of Discussion (M/D) Draft. (Departure of Team Leader from Tokyo.)
4	06.09	Wed.	Fine	Kampala		Site Survey (Queensway, Kisugu and Kisubi Substations and Motor Mart Switching Stations).
5	06.10	Thu.	Fine	Kampala		Arrival of Team Leader (Mr. Morimoto) in Uganda. Courtesy visit to the Ministry of Natural Resources (formerly the Ministry of Water, Energy, Minerals & Environment Protection). Meeting with UEB on M/D.
6	06.11	Fri.	Fine	Kampala		Courtesy Visit to the Managing Director of UEB. Discussion with UEB on M/D.
7	06.12	Sat.	Fine	Kampala		Site Survey (Kawanda, Ntinda and Kawala Substations).
8	06.13	Sun.	Fine	Kampala		Internal Meeting of Study Team.
9	06.14	Mon.	Fine	Kampala		Courtesy visit to the Ministry of Foreign Affairs, and the Ministry of Finance and Economic Planning. Signing of M/D. (Departure of Team Leader from Uganda at 19:00 on QU312.)
10	06.15	Tue.	Rain, then clear	Kampala		Meeting with UEB. Consolidation of Data & Information. Market Survey.
11	06.16	Wed.	Rain, then clear	Kampala		Same as above.
12	06.17	Thu.	Rain, then clear	Kampala		Same as above.
13	06.18	Fri.	Fine	Kampala		Site Survey (Mutundwe, Kampala South, Gaba, Lugogo, Port Bell, and Kireka Substations).
14	06.19	Sat.	Rain, then clear	Kampala		Meeting with UEB. Site Survey (Entebbe and Kajansi Substations).

No.	Date	Day of Week	Weather	Place of Stay	Schedule	Activities
15	06.20	Sun.	Fine	Kampala		Internal Meeting of Study Team. Consolidation of Data & Information
16	06.21	Mon.	Rain, then clear	Kampala		Site Survey (Njeru and Jinja Industrial Substations).
17	06.22	Tue.	Rain, then clear	Kampala		Meeting with UEB. Consolidation of Data & Information. Market Survey.
18	06.23	Wed.	Rain, then clear	Kampala		Survey of Power Service Situation in Kampala city. Meeting with UEB.
19	06.24	Thu.	Fine	Kampala		Meeting with UEB. Consolidation of Data & Information. Market Survey.
20	06.25	Fri.	Fine	Kampala		Preparation of Field Report. Market Survey.
21	06.26	Sat.	Rain, then clear	Kampala		Site Survey (Kisugu, Ntinda, Kawanda, Kawala, Kampala South and Kisubi Substations). Preparation of Field Report.
22	06.27	Sun.	Rain, then clear	Kampala		Site Survey (Njeru Substation). Internal Meeting of Study Team
23	06.28	Mon.	Fine	Kampala		Preparation of Field Report. Consolidation of Data & Information. Market Survey.
24	06.29	Tue.	Fine	Kampala		Site Survey (Kawala Substation). Preparation of Field Report. Market Survey.
25	06.30	Wed.	Fine	Kampala		Preparation of Field Report. Meeting with UEB.
26	07.01	Thu.	Fine	Kampala		Collection of Data & Information for Field Report (Draft) with UEB.
27	07.02	Fri.	Rain, then clear	Kampala		Discussion of Field Report (Draft) with UEB. Consolidation of Data & Information. (Departure of Team Member, Mr. Chiba from Uganda at 15:00 on KQ415.)
28	07.03	Sat.	Rain, then clear	Kampala		Site Survey (Tororo Substation, Transmission Lines in Eastern Region).
29	07.04	Sun.	Rain, then clear	Kampala		Preparation of Field Report. Internal Meeting of Study Team.
30	07.05	Mon.		Kampala		Submittal and Discussion of Field Report with UEB. (Arrival of Team Member, Mr. Chiba, at Narita, 12:00 on BA007.)
31	07.06	Tue.	Fine	Kampala		Site Survey (Masindi Substation).

No.	Date	Day of Week	Weather	Place of Stay	Schedule	Activities
32	07.07	Wed.	Fine	Kampala		Site Survey (Transmission lines in Northern Region).
33	07.08	Thu.	Fine	Kampala		Final Discussion and Confirmation of Field Report with UEB. Consolidation of Data & Information Market Research.
34	07.09	Fri.	Fine	Kampala		Courtesy Visit to UEB. Consolidation of Collected Data.
35	07.10	Sat.	Fine	Kampala		Consolidation of Collected Data Internal Meeting of Study Team.
36	07.11	Sun.	Fine	Nairobi	Lv. Kampala at 08:00 on KQ105 Ar. Nairobi at 09:00	Departure of Study Team (Mr. Okabe and Mr. Komiya) from Uganda.
37	07.12	Mon.	Fine	Nairobi		Courtesy Call to JICA Kenya Office and Embassy of Japan in Kenya.
38	07.13	Tue.	Fine	London	Lv. Nairobi at 10:00 on BA068 Ar. London at 16:45	
39	07.14	Wed.	Fine	In airplane	Lv. London at 12:55 on BA005	
40	07.15	Thu.	Fine	At Narita at 08:45	Ar Narita at 08:45	Arrival of Study Team (Mr. Okabe and Mr. Komiya) at Narita.

2. The Schedule of the Field Survey (Consultation of Draft Report)

No.	Date	Day of Week	Weather	Place of Stay	Schedule	Activities
1	09.02	Thu.	Fine	Frankfurt	Lv. Narita at 14:05 on LH711. Ar. Frankfurt at 18:55.	Departure of Basic Design Study Team (Consultant Team, Mr. Okabe and Mr. Komiya) from Tokyo.
2	09.03	Fri.	Fine	In airplane	Lv. Frankfurt at 23:15 on LH574.	
3	09.04	Sat.	Fine	Kampala	Ar. Nairobi at 08:20. Lv. Nairobi at 11:30 on QU361. Ar. Entebbe at 13:15.	Arrival of Consultant Team at Kampala. Explanation and Discussion of Draft Report with UEB.
4	09.05	Sun.	Fine	Kampala		Meeting with UEB.
5	09.06	Mon.	Fine	Kampala		Explanation and Discussion of Draft Report, Field Survey Schedule and Minutes of Discussion (M/D) Draft with UEB. Site Survey at Project Sites.
6	09.07	Tue.	Fine	Kampala		Same as above.
7	09.08	Wed.	Fine	Kampala		Same as above. Meeting with Mr. Shibata of JICA Kenya office.
8	09.09	Thu.	Fine	Nairobi	(Team Leader) Ar. Entebbe at 05:45 on BA069. (Consultant Team) Lv. Entebbe at 13:45 on QU342. Ar. Nairobi at 15:30.	Arrival in Kampala of Team Leader, Ms. Eri Honda. Signing of M/D. Courtesy call to Mr. Henry Kajura, Minister of Ministry of Natural Resources (formerly the Ministry of Water, Energy, Minerals & Environment Protection). Departure of Consultant Team from Kampala.
9	09.10	Fri.	Fine	Nairobi		Courtesy call to JICA Kenya office and Embassy of Japan in Kenya.
10	09.11	Sat.	Fine	London	Lv. Nairobi at 10:25 on BA068 Ar. London (LHR) at 17:10.	
11	09.12	Sun.	Fine	In airplane	Lv. London (LHR) at 18:00 on NH202.	
12	09.13	Mon.	Fine		Ar. Tokyo at 13:50.	Arrival of Consultant Team at Narita

APPENDIX 3 MEMBER LIST OF CONCERNED PARTIES IN THE RECIPIENT COUNTRY

LIST OF INTERVIEWEES

Place of Work and Name	Position
Ministry of Foreign Affairs MOFA):	
Mr. N. Odoi	Permanent Secretary
Mr. Bakayana	Director of Japan Desk
Mr. Kwoba Godfrey	Foreign Service Officer
Ministry of Finance and Economic Planning(MOFEP):	
Mr. Abbey Kafumbe Mukasa	Deputy Minister
Mr. Emmanuel Katwe	Senior Finance Officer of External Aid
Ministry of Natural Resources:	
Mr. Henry Kajura	Minister
Mr. Ben Z. Dramadri	Permanent Secretary
Uganda Electricity Board (UEB):	
Mr. A.R. Rutta	Managing Director
Mr. Simon G. D'Ujanga	Deputy Managing Director (Technical)
Mr. E.N. Nzabanita	Chief Development Manager
Mr. G.S. Kagolobya	Chief Distribution Manager
Mr. Charles W.K. Rwemereza	Chief Commercial Manager
Mr. Y.B.K. Mpagi	Project Coordinator
Mr. K. Karekaho	Deputy Chief Development Manager
Mr. Henry Lwetabe	Deputy Chief Finance Manager(Project)
Mr. Chris Eyahura	Deputy Chief Finance Manager
Ms. Placid Ssekamatte	Deputy Chief Corporate Planner
Mr. Muganga Gerald	Principal Planning Engineer
Ms. Catherine Senyondwa	Principal Protection Engineer
Mr. E. Kiyemba	Principal Control Engineer
Mr. H. Senyondwa	Principal Constructing Engineer
Mr. N. Kasendwa	Principal Civil Engineer
Mr. JR. Engola Anyeko	Kampala District Manager
Uganda Electricity Board (UEB) (cont.):	
Mr. Kasumba Moses	Senior Civil Engineer
Mr. Enock Kaggwa	Construction Engineer
Mr. Rod Vincent	Project Manger of Third Power Project
Mr. R. Jonathan Rutabingwa	Surveyor
Mr. Magenyi Moses	Drawing Officer Supervisor

District Office:

Mr. Vincent Kyabaggu.....Jinja District Manager
Mr. B.S. Baraba.....Tororo District Manager/Engineer(Eastern)
Mr. Michael E. Nguma.....Masindi District Manager

Embassy of Japan in Kenya:

Mr. Shigeru Takahara .....First Secretary

JICA Kenya Office:

Mr. Toshikazu Nagashima.....Resident Representative
Mr. Sumio Aoki.....Deputy Director
Mr. Shinji Shibata.....Assistant Resident Representative