SECTION V

4.2 GENERAL AND DEFINITE SCOPE OF WORKS

FOR

LINES AND SUBSTATIONS

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4.2 SCOPE OF WORKS

4.2.1 SCOPE FOR 132KV, 66KV, 33KV AND 11KV LINES

4.2.1.1 General

The Bidder shall examine the scope of works in this section in close connection with the other documents and particulars forming these Bidding Documents.

Special attention shall be paid to the Technical Specifications, where the general technical requirements are specified. The drawings enclosed herein are for bidding purposes only.

If the Specifications and/or Drawings do not contain particulars of materials or goods that are necessary for the proper and safe completion, operation and maintenance of the equipment in question, all such materials shall be deemed to be included in the supply.

In the event of any conflict between the Drawings and the Specifications, the latter shall prevail.

In the event of any conflict between scaled dimensions and figures on the Drawings, the figures shall prevail.

Should the Bidder find discrepancies in or omissions from these Specifications or from the other Documents, or should he be in doubt as to their meaning, he should immediately contact the Project Manager for interpretation, clarification or correction thereof before submitting his Bid. Such action shall, however, in no case be considered as a cause for altering the closing date of the Bid.

The scope of work covers supply of equipment, engineering and design, manufacture, testing before shipment and packing sea worthy or otherwise as required, delivery of all equipment to site (DDP), construction and installation and commissioning.

Where the new line share the route with existing lines, the scope of work shall include all the necessary works/modifications that will be required to accommodate the lines along the same route. The conductors of the existing lines shall be re-used while new hardware/fittings of correct type and size shall be used.

The term "transfer" in this scope of works shall mean supply of new hardware/fittings, new concrete poles, stays, insulators as well as installation of these in the existing line routes. It also includes moving all equipment, such as distribution transformers, autoreclosers, switches and links, capacitor banks etc, mounted on the present poles over to the new poles. All existing poles, conductors and hardware/fittings shall be recovered and handed over to the KPLC stores at locations nearest to the installation sites.

The scope of work for a transmission line shall cover design, manufacture, testing, supply, shipping, transportation and delivery to site, unloading, check survey and all associated profile plotting, support pegging, provision of access facilities and route clearing, installation of foundations and all associated civil works. Erection of towers, stringing, sagging, crimping, installation, testing and commissioning of the line and associated line bay.

Transmission lines shall be constructed on steel lattice or monopole towers meeting KPLC and internationally accepted standards. The specifications for transmission line design and specifications are details under Particular Technical Specifications for transmission lines.

4.2.1.2 Cross arms:

Steel cross-arms shall be used in all cases including re-conductoring. All steel cross arms shall be grounded and shall meet international accepted standards in addition to KPLC specifications for steel structures and line fittings.

4.2.1.3 Line Conductor

The 11kV and 33kV Overhead line conductors shall be 150mm2 ACSR.
The 66kV overhead conductor shall be 300mm2 AAAC.
The 132kV overhead conductor shall be 175mm2 Lynx.
The Alternative 132kV Overhead conductor shall be 223mm2 ACCC.

4.2.1.4 Conductor Joints and Terminations

All joints and terminations shall be of **compression type** for conductors of 150mm2 and above.

4.2.1.5 Poles:

Concrete poles shall be used in all 66, 33 and 11kV overhead line construction. All poles shall meet design class of 50SC (10, 11 and 12m) poles and 75SC (14 and 15m) poles and KPLC Pre-stressed concrete poles particular specifications.

4.2.1.6 Line Towers:

Monopole towers shall be self-supporting, galvanized single-pole steel tubular type with body extensions. The body extensions shall be in sections of 1m and 3m in length. designed for multi-circuit use in urban areas.
For lattice steel towers a fully triangulated system of bracings shall preferably be adopted for its overall stability.
No member of the lattice tower shall be less than 6mm in thickness and 50mm in width of flange for leg members of towers and main members of the cross-arm, and 5mm and 45mm for the web and nominal members respectively.
These tower designs shall be double circuit 132 kV top and 33 kV double circuits mounted below. It shall also have provisions to carry 48 cores OPGW cable and ground Earth wire at top for lightning protection of the double circuit transmission line.
Shall meet all specifications as prescribed in the Particular Technical Specification for Overhead lines and BS 8100, BS EN 50341 and BS EN 10163 plus other internationally acceptable standards.

4.2.1.7 Optical Ground Wire:

OPGW (Optical Ground Wire) shall be used in all the 33kV and above overhead lines. The standard size used by KPLC is 48 cores single mode Optic fiber. OPGW earthing shall be done after every fourth pole.

Where the 33kV and 66kV line is done in underground cable, an Underground Fibre Optic cable will be laid together in the trace of the MV cable.

4.2.1.8 Factory Acceptance Test

The Contractor shall arrange for 2 participants from KPLC and the Project Manager to witness tests of major equipment listed below in the manufacturer's plant. All routine tests shall be carried out in the presence of the Employer's representatives. The Contractor shall arrange for the FAT and meet full cost of the air tickets, local transport, training and training at manufacturer's factory. The KPLC staff per diem costs shall be based on SRC rates or individual KPLC designation rates whichever is higher.

The following major equipment shall be offered for inspection

- Phase conductors (ACSR, 223mm^2 ACCC and 300mm^2 AAAC Conductors)
- OPGW and FO Underground cable
- Line hardware
- Insulators & Surge Arrestors
- Power Cables
- 132 kV Cable termination and Sealing end kits
- Circuit Breakers and Auto reclosers
- Isolators
- Instrument transformers
- Concrete Poles
- Towers – Monopoles and Steel Latice and associated hardware

FAT shall be carried out as prescribed in the Particular Technical Specification.

SCOPE OF SUBSTATIONS WORK

4.2.1.9 General

The Bidder shall examine the scope of works in this section in close connection with the other documents and particulars forming these Bidding Documents.

Special attention shall be paid to General Specifications and Particular Technical Specifications, in which the general technical requirements are specified. The drawings enclosed herein are for bidding purposes only.

If the Specifications and/or Drawings do not contain particulars of materials or goods, which are necessary for the proper and safe completion, operation, and maintenance of the equipment in question, all such materials shall be deemed included in the supply.

In the event of any conflict between the Drawings and the Specifications, the latter shall prevail.

In the event of any conflict between scaled dimensions and figures on the Drawings, the figures shall prevail.

Should the Bidder find discrepancies in or omissions from these Specifications or from the other Documents, or should he be in doubt as to their meaning, he should immediately contact the Project Manager for interpretation, clarification or correction thereof before submitting his Bid. Such action shall, however, in no case be considered as a cause for altering the closing date of the Bid.

The scope of work for equipment shall cover engineering design, manufacture, testing before shipment and packing sea worthy or otherwise as required, delivery duty paid to site (DDP), of all equipment as specified in the preceding chapters.

For substations contracted on turn-key basis the substation contractor shall be responsible for design, supply material, transport, erection, installation, test and commissioning as well as having the full responsibility for civil works including design and construction of equipment foundations and control building.

The Contractor shall design and construct the transformer foundations with oil collection pit, oil trap (Oil interceptor) and fire damper consisting of crushed stones laying on a galvanized steel grating. Firewall shall be constructed where necessary.

Loose equipment for the Employer’s rehabilitation shall be complete with documentation and ancillaries like programs, licenses and programming tools.

Equipment that is to be dismantled and removed from existing substations is to be recovered by the Contractor and deposited to KPLC stores as designated by the Employer. The recovered equipment is to be taken over by the Employer at these stores.

4.2.1.10 Standard Substation

This section defines the standard substation components. The actual Scope and quantities to be included in the price schedules are found for each substation in the subsequent sections.

4.2.1.10.1 132kV Bays

4.2.2.3.2.1 Transformer Bay (132/xxx kV)

One complete 132kV / xxxkV Transformer Bay (HV & MV) shall be equipped with:

a) 1 (One) HV and 1 (One) MV Circuit breaker - Ganged mechanism
b) 1 (One) HV and 1 (One) MV motorised isolator
c) 2 (two) sets of busbars materials and post insulators (HV & MV)
d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the transformer bushings, to the busbars and between the apparatus.
e) 2 (two) set of current transformers (HV & MV)
f) 1 (one) MV neutral current transformer with neutral isolating link
g) 2 (two) set of surge diverters (HV & MV) installed close to the power transformer
h) 1 (one) set of steel structures for equipment support
i) Numerical automatic voltage regulating relay (AVR) compliant to IEC61850 standards
j) 2 (two) Control panels (HV & MV) equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs*:
    i) 2 (two) Bay Control Units with control and measurement (HV & MV)
    ii) 2 (two) multifunctional meters for measurement and display of kV, I, MVAR, MW (HV & MV)
    iii) Set of Mimic, Semaphores, indications, discrepancy switches and instruments (HV & MV)
    iv) Annunciation relay for Alarms and trips
    v) Set of trip circuit supervision relay (HV & MV)
    vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.
k) 2 (two) Protection panels equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs*:
    i) 1 (one) differential protection function
    ii) 1 (one) restricted earth fault function
    iii) 2 (two) overcurrent and earth fault protection function. (HV & MV)
    iv) 1 (one) MV neutral point earth fault relay function
    v) 2 (two) lock-out trip relay with electrical and hand reset facilities (HV & MV)
    vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protective scheme which shall be prepared for SCADA operation.

4.2.2.2.1.2 132kV Line Bay

1 complete 132KV Line Bay shall be equipped with:

a) 1 (one) circuit breaker - Single pole mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) earthing switch
d) 1 (one) set of busbars materials and post insulators
e) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.

f) 1 (one) set of current transformers
g) 1 (one) set of voltage transformers
h) 1 (one) set of surge diverters
i) 1 (one) set of steel structures for equipment support
j) 1 (one) Control panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs*:
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation

i) 2 (two) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs*:
   ii) 1 (one) multifunctional line protection IED unit (Main A) with both line distance and line differential functions.
   iii) 1 (one) multifunctional line protection IED unit (Main B) with line distance functions.
   iv) 1 (one) sensitive earth fault function
   v) HV overcurrent and earth fault protection function.
   vi) 1 (one) lock-out trip relay with electrical and hand reset facilities
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.1.3 132kV Bus Section / Bus Coupler Bay

1 (one) complete 132kV Bus Section / Bus Coupler Bay shall be equipped with:

a) 1 (one) circuit breaker – Ganged Mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) set of busbars materials and post insulators
d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
e) 1 (one) set of current transformers
f) 2 (two) set of voltage transformers
g) 1 (one) set of steel structures for equipment support
h) 1 (one) Control panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs*:
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   iv) Annunciation relay for alarms and trips
   v) Set of trip circuit supervision relays
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation
k) 1 (one) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*

i) HV overcurrent and earth fault protection function.
ii) 1 (one) lock-out trip relay with electrical and hand reset facilities
iii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.1.4 132kV Bus Bar Protection

1 (one) 132kV Bus bar protection and control panel shall have a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*

a) 1 (one) multifunctional IED unit with busbar protection function
b) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation
c) Annunciation relay for alarms and trips
d) 1 (one) lock-out trip relay with electrical and hand reset facilities

Note

For Kipevu 132 KV substations

- The Line bays, Bus section bays and Busbar extensions should adopt the existing Substation layouts/arrangements, busbar and equipment ratings.
- The Line Bay and Bus section bay control schemes shall be integrated to the existing SCADA for operation, signaling, command, alarms, indications & energy measurements.

4.2.1.10.2 66 kV Bays

4.2.2.2.2.1 Transformer Bay (66 /33/11 kV)

One complete 66kV/33/11kV Transformer Bay (HV & MV) shall be equipped with:

a) 1 (One) HV and 1 (One) MV Circuit breaker - Ganged mechanism
b) 1 (One) HV and 1 (One) MV motorised isolator
c) 2 (two) sets of busbars materials and post insulators (HV & MV)
d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the transformer bushings, to the busbars and between the apparatus.
e) 2 (two) set of current transformers (HV & MV)
f) 1 (one) MV neutral current transformer with neutral isolating link
g) 2 (two) set of surge diverters (HV & MV) installed close to the power transformer
h) 1 (one) set of steel structures for equipment support
i) Numerical automatic voltage regulating relay (AVR) compliant to IEC61850 standards
j) 2 (two) Control panels (HV & MV) equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 2 (two) Bay Control Unit with control and measurement (HV & MV)
   ii) 2 (two) multifunctional meters for measurement and display of kV, I, MVAR, MW (HV & MV)
   iii) Set of Mimic, Semaphores, indications, discrepancy switches and instruments
   iv) Annunciation relay for Alarms and trips
   v) Set of trip circuit supervision relay (HV & MV)
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

k) 2 (two) Protection panels equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) differential protection function
   ii) 1 (one) restricted earth fault function
   iii) 2 (two) Overcurrent and earth fault protection IED. (HV & MV)
   iv) 1 (one) MV neutral point earth fault relay function
   v) 2 (two) lock-out trip relay with electrical and hand reset facilities (HV & MV)
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protective scheme which shall be prepared for SCADA operation.

4.2.2.2.2.2 66kV Line Bay

1 complete 66KV Line Bay shall be equipped with:

a) 1 (one) circuit breaker - Ganged mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) earthing switch
d) 1 (one) set of busbars materials and post insulators
e) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
f) 1 (one) set of current transformers
g) 1 (one) set of voltage transformers
h) 1 (one) set of surge diverters
i) 1 (one) set of steel structures for equipment support
j) 1 (one) Control panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

k) 2 (two) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) multifunctional line protection IED unit with both line distance and line differential functions.
   ii) 1 (one) sensitive earth fault function
   iii) HV overcurrent and earth fault protection function.
   iv) 1 (one) lock-out trip relay with electrical and hand reset facilities
   v) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.2.3 66kV Bus Section / Bus Coupler Bay

1 (one) complete 66kV Bus Section / Bus Coupler Bay shall be equipped with:

a) 1 (one) circuit breaker – Ganged Mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) set of busbars materials and post insulators

d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
e) 1 (one) set of current transformers
f) 2 (two) set of voltage transformers
g) 1 (one) set of steel structures for equipment support
h) 1 (one) Control panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   iv) Annunciation relay for alarms and trips
   v) Set of trip circuit supervision relays
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

l) 1 (one) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) HV overcurrent and earth fault protection function.
   ii) 1 (one) lock-out trip relay with electrical and hand reset facilities
   iii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.2.4 66kV Bus Bar Protection

1 (one) 66kV Bus bar protection and control panel shall have a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
a) 1 (one) multifunctional IED unit with busbar protection function
b) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation
c) Annunciation relay for alarms and trips
d) 1 (one) lock-out trip relay with electrical and hand reset facilities

4.2.1.10.3 33kV Bays

4.2.2.2.3.1 Transformer Bay (33 / xxx kV)

One complete 33kV / xxxkV Transformer Bay (HV & LV) shall be equipped with:
a) 1 (One) MV and 1 (One) LV Circuit breaker - Ganged mechanism
b) 1 (One) MV and 1 (One) LV motorised isolator
c) 2 (two) sets of busbars materials and post insulators (MV & LV)
d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the transformer bushings, to the busbars and between the apparatus.
e) 2 (two) set of current transformers (MV & LV)
f) 1 (one) LV neutral current transformer with neutral isolating link
g) 2 (two) set of surge diverters (MV & LV) installed close to the power transformer
h) 1 (one) set of steel structures for equipment support
i) Numerical automatic voltage regulating relay (AVR) compliant to IEC61850 standards

j) 1 (one) Control panels (MV & LV) equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control Unit with control and measurement (MV & LV)
   ii) 2 (two) multifunctional meters for measurement and display of kV, I, MVAR, MW (MV & LV)
   iii) Set of Mimic, Semaphores, indications, discrepancy switches and instruments
   iv) Annunciation relay for Alarms and trips
   v) Set of trip circuit supervision relay (MV & LV)
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

k) 1 (one) Protection panels equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) differential protection function
   ii) 1 (one) restricted earth fault function
   iii) 2 (two) Overcurrent and earth fault protection IED. (MV & LV)
   iv) 1 (one) LV neutral point earth fault relay function
   v) 2 (two) lock-out trip relay with electrical and hand reset facilities (MV & LV)
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protective scheme which shall be prepared for SCADA operation

4.2.2.2.3.2 33kV Line Bay

1 complete 33KV Line Bay shall be equipped with:

a) 1 (one) circuit breaker - Ganged mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) earthing switch
d) 1 (one) set of busbars materials and post insulators
e) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
f) 1 (one) set of current transformers
g) 1 (one) set of voltage transformers
h) 1 (one) set of surge diverters
i) 1 (one) set of steel structures for equipment support
j) 1 (one) Control panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.

k) 2 (two) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) multifunctional line protection IED unit with both line distance function.

ii) 1 (one) sensitive earth fault function
iii) MV overcurrent and earth fault protection function.
iv) 1 (one) lock-out trip relay with electrical and hand reset facilities
v) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.3.3 33kV Bus Section / Bus Coupler Bay

1 (one) complete 33kV Bus Section / Bus Coupler Bay shall be equipped with:

a) 1 (one) circuit breaker – Ganged Mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) set of busbars materials and post insulators
d) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
e) 1 (one) set of current transformers
f) 2 (two) set of voltage transformers
g) 1 (one) set of steel structures for equipment support
h) 1 (one) Control panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   iv) Annunciation relay for alarms and trips
   v) Set of trip circuit supervision relays
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation.
i) 1 (one) Protection panel equipped with a minimum of following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) HV overcurrent and earth fault protection function.
   ii) 1 (one) lock-out trip relay with electrical and hand reset facilities
   iii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.3.4 33kV Auxiliary Supply Transformer Bay

1 (one) complete 33kV Auxiliary Supply Bay shall be equipped with:

a) 1 (one) 100kVA 33/0.415kV Dyn11 Auxiliary Transformer
b) 1 (one) set of 33kV Drop out fuses
c) 1 (one) lot three-phase line materials including post insulators, clamps for the flying busbars and for connection between the busbars and the equipment.
d) 1 (one) set of 33kV Surge Arrestors

4.2.2.2.3.5 33kV Switching Station

1 (one) complete 33kV Switching Station shall be equipped with the following minimum equipment:

a) 4 (four) auto recloser complete with bypass switch, isolating links and surge arrestors
b) 4 (four) 33kv Isolators
c) Auxiliary supply transformer 50kVA 33/0.415kV
d) 1 (one) set of busbars materials and insulators
e) 4 (four) sets of surge diverters
f) 1 (one) lot of support structures
g) 1 (one) prefabricated building

h) 1 (one) lot three-phase line materials including post insulators, clamps for the flying busbars and for connection between the busbars and the equipment.

4.2.1.10.4 11kV Bays _ Outdoor Switchgear

4.2.2.2.4.1 11kV Feeder Bay

1 complete 11KV Feeder Bay shall be equipped with:

a) 1 (one) circuit breaker - Ganged mechanism
b) 2 (two) isolators with motor operation
c) 1 (one) earthing switch
d) 1 (one) set of busbars materials and post insulators
e) 1 (one) complete set of three-phase line materials including clamps for the flying busbars and for connection between the gantries, to the busbars and between the apparatus.
f) 1 (one) set of current transformers
g) 1 (one) set of surge diverters
h) 1 (one) set of steel structures for equipment support.
i) 1 (one) Control and Protection panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control and Protection Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation
   vi) 1 (one) sensitive earth fault function
   vii) 1 (one) LV overcurrent and earth fault protection function.
   viii) Autoreclose function
   ix) 1 (one) lock-out trip relay with electrical and hand reset facilities
   x) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.4.2 11kV Auxillary Supply Transformer Bay

1 (one) complete 11kV Auxillary Supply Bay shall be equipped with:

a) 1 (one) 100kVA 11/0.415kV Dyn11 Auxillary Transformer
b) 1 (one) set of 11kV Drop out fuses
c) 1 (one) lot three-phase line materials including post insulators, clamps for the flying busbars and for connection between the busbars and the equipment.
d) 1 (one) set of 11kV Surge Arrestors

4.2.1.10.5 11kV Bays _ Indoor Switchgear Panels

4.2.2.2.5.3 11kV Transformer Incomer Indoor Bay

1 complete 11KV Transformer Incomer Bay shall be equipped with:

a) 1 (one) Withdrawable circuit breaker
b) 1 (one) earthing switch
c) 1 (one) set of busbars materials
d) 1 (one) set of current transformers

e) 1 (one) set of Voltage transformers (with a facility for primary isolation)
f) 1 (one) Control and Protection panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control and Protection Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation
   viii) 1 (one) LV Overcurrent and earth fault protection function.
   ix) Autoreclose function
   x) 1 (one) restricted earth fault function *(If NOT included in Tx HV panel)*
   xi) 1 (one) lock-out trip relay with electrical and hand reset facilities
   xii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.5.2 11kV Feeder Indoor Bay

1 complete 11KV Feeder Indoor Bay shall be equipped with:
a) 1 (one) Withdrawable circuit breaker
b) 1 (one) earthing switch
c) 1 (one) set of busbars materials
d) 1 (one) set of current transformers
e) 1 (one) set of surge diverters
f) 1 (one) Control and Protection panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control and Protection Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) 1 (one) tariff energy meter
   iv) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   v) Annunciation relay for alarms and trips
   vi) Set of trip circuit supervision relays
   vii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation
   viii) 1 (one) sensitive earth fault function
   ix) 1 (one) LV Overcurrent and earth fault protection function.
   x) Autoreclose function
   xi) 1 (one) lock-out trip relay with electrical and hand reset facilities
   xii) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.5.3 11kV Bus Section Indoor Bay

1 complete 11KV Bus Section Bay shall be equipped with:
a) 1 (one) Withdrawable circuit breaker
b) 2 (two) earthing switch *(if NOT provided elsewhere on the Indoor Switchgear board)*
c) 1 (one) set of busbars materials

d) 1 (one) set of current transformers
e) 2 (two) sets of Voltage transformers - with a facility for primary isolation *(one set for each bus section. if NOT provided elsewhere on the Indoor Switchgear board)*
f) 1 (one) Control and Protection panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) Bay Control and Protection Unit with control and measurement
   ii) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   iii) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   iv) Annunciation relay for alarms and trips
   v) Set of trip circuit supervision relays
   vi) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation
   vii) 1 (one) LV Overcurrent and earth fault protection function.
   viii) 1 (one) lock-out trip relay with electrical and hand reset facilities
   ix) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative protection scheme which shall be prepared for SCADA operation

4.2.2.2.5.4 11kV Auxiliary Transformer Indoor Bay

1 complete 11KV Auxiliary Transformer Bay shall be equipped with:
a) 1 (one) Withdrawable motorised fuse switch
b) 1 (one) earthing switch
c) 1 (one) set of busbars materials
d) 1 (one) Control and Protection panel equipped with a minimum of the following IEDs and components as described in **Section VI - Clause 4.1.2.3.2** – *Protection Schemes & IEDs:*
   i) 1 (one) multifunctional meter for measurement and display of kV, I, MVAR, MW
   ii) Panel mimic diagram, semaphores, indications, discrepancy switches and instruments.
   iii) Annunciation relay for alarms and trips
   iv) 1 (one) lot of necessary interposing relays, MCB's, terminal blocks and wiring to form a complete operative bay control. The control scheme shall be prepared for SCADA operation

4.2.1.10.6 Current Transformer Technical Data

The current transformers shall have cores whose Ratio, Class and Burden shall be as specified in tables below. LV and HV windings for the current transformers for this project shall be made of high grade copper. Aluminium windings shall not the accepted.

Where in the attached KPLC specifications require use of Aluminium or Copper windings, it shall be ignored.

The CTs shall also meet all the other requirements contained in the attached KPLC Specifications for 33kV current transformers.

Table 4.2.2.2.6.1: Current transformer technical parameters (2.5MVA - 7.5MVA, 33/11kV S/S)

33kV			11kV		11kV	
Line Bay/ Transformer Bay HV)			Transformer Bay (LV)		Feeder Bay	
Core	Ratio	Class/Burden	Ratio	Class/Burden	Ratio	Class/Burden
1	400/200/100/1-1-1A	0.2/15VA	400/200/100/1-1-1A	0.2/15VA	400/200/100/1-1-1A	0.2/15VA
2	400/200/100/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA
3	400/200/100/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA
4	400/200/100/1-1-1A	X/Vk>350V Ik<30mA	400/200/100/1-1-1A	X/Vk>350V Ik<30mA	400/200/100/1-1-1A	X/Vk>350V Ik<30mA

Table 4.2.2.2.6.2:
Current transformer technical parameters (10MVA - 23MVA, 33/11kV S/S)

33kV			11kV		11kV	
Line Bay/ Transformer Bay HV)			Transformer Bay (LV)		Feeder Bay	
Core	Ratio	Class/Burden	Ratio	Class/Burden	Ratio	Class/Burden
1	400/200/100/1-1-1A	0.2/15VA	1200/600/300/1-1-1A	0.2/15VA	400/200/100/1-1-1A	0.2/15VA
2	400/200/100/1-1-1A	5P20/15VA	1200/600/300/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA
3	400/200/100/1-1-1A	5P20/15VA	1200/600/300/1-1-1A	5P20/15VA	400/200/100/1-1-1A	5P20/15VA
4	400/200/100/1-1-1A	X/Vk>350V Ik<30mA	1200/600/300/1-1-1A	X/Vk>350V Ik<30mA	400/200/100/1-1-1A	X/Vk>350V Ik<30mA

Table 4.2.2.2.6.3: Current transformer technical parameters (23MVA and above, 132/66kV S/S)

132kV			33kV		33kV	
Line Bay/ Transformer Bay (HV)			Transformer Bay (LV)		Feeder Bay	
Core	Ratio	Class/Burden	Ratio	Class/Burden	Ratio	Class/Burden
1	400/200/100/1-1-1A	0.2/15VA	800/400/1-1A	0.2/15VA	400/200/1A	0.2/15VA
2	400/200/100/1-1-1A	5P20/15VA	800/400/1-1A	5P20/15VA	400/200/1A	5P20/15VA
3	400/200/100/1-1-1A	5P20/15VA	800/400/1-1A	5P20/15VA	400/200/1A	5P20/15VA
4	400/200/100/1-1-1A	X/Vk>350V Ik<30mA	800/400/1-1A	X/Vk>350V Ik<30mA	400/200/1A	X/Vk>350V Ik<30mA

Note: *If the Current Transformer Short circuit current withstand, Ratio, Burden and Class in the **attached KPLC CT specifications** differ with the values given in the scope for the works, the **parameters** in the scope of works shall apply(prevail).*

4.2.1.10.7 Outdoor Voltage Transformer Technical Data

The technical parameters for the Voltage transformer for this project shall meet following requirements in addition to those specified in attached KPLC specifications for Voltage transformers.

Voltage transformer LV and HV windings shall be made of high grade copper, Aluminium windings shall not be accepted in this project.

Metering core accuracy class shall be **0.2** and not **0.5** as specified in the attached KPLC specifications for Voltage transformers.

Note: *If the Voltage Transformer Ratio, Burden and Class in the* ***attached KPLC CT specifications*** *differ with the values given in the scope for the works, the* ***parameters*** *in the scope of works shall apply(prevail).*

4.2.1.10.8 Outdoor Bus Bar and Line Conductor

The bus bar shall use high grade tubular Aluminium alloy, or 2 x 300mm2 AAA Conductor. 33kV and 11kV Overhead line conductors shall be 150mm2 ACSR, while 100mm2 AA conductors shall be used in 0.415kV LV Overhead lines, 300mm2 shall be used in 66Kv overhead lines and 223mm2 ACCC for the 132kV transmission lines. Material for tubular busbar shall Aluminium-magnesium-silicon tubes in accordance with IEC 60114. They shall be designed to withstand thermal and dynamic stresses under normal duty and maximal short-circuit current without damage. Fastening shall be such that thermal expansion is accommodated without any undue stress

4.2.1.11 Substation Automation System - SCADA/RTU Panel

4.2.1.11.1 General

1(one) lot of complete Substation Automation System (equipment and software) for substation control, operation and monitoring.

To the extent the internal control and interlocking system for the equipment supplied is not included for that particular equipment, it shall be included herein. All interconnections needed to form a complete installation shall also be included herein.

The control system specified hereunder shall include all necessary equipment for control, protection, metering and signaling. The system shall include all instruments, meters, switches, position indicators, inscriptions and mimic diagrams, protective and auxiliary relays, terminal blocks, internal wiring and any other equipment required to form a complete installation.

Drawings showing the control system, protection units and the boards as they are proposed shall be supplied with the Bid.

The space needed for the boards should not exceed the available space.
Information defining the internal local control communication protocol shall be submitted with the Bid.

Complete sets of schematic diagrams for control, protection, indication, metering, signaling, alarms, etc. shall be supplied as part of the project and shall be subject to the Project Manager's approval.

The requirements as to submission of diagrams, drawings and other documents with the Bid and after award of Contract are stated in the standard form of contract.

4.2.1.11.2 Scope of Substation Automation System (SAS):

4.2.2.3.2.1 Scope of Substation Automation System (SAS) for 132/66/33/11kV S/S with 7.5 MVA transformer and above.

The system scope shall include detailed system design, manufacture, supply, installation, testing, and commissioning of complete functional SAS system

The proposed SAS system shall at least have the following functionality: -

a) Full operational Control, Monitoring, Reporting, Alarm, Signaling and Indications facilities for NCC/RCC station control (Supervisory level).
b) Full operational control, Monitoring, reporting, alarm and indications facilities for the substation from the Human Machine interface (HMI) workstations in the substation control room (Substation Level).
c) Operational control of each new circuit/bay from the protection relay panel using the bay control unit LCD display (Bay level).
d) Control of each item of plant from the Local Control Cubicle (LCC) (Local Level)
e) The control facilities from each control point are to be interlocked (hardwired) to prevent operation of any device simultaneously from more than one control point.
f) At least one fully operational control point shall remain available in the event of a single equipment or communications failure.
g) Complete facilities must exist for the proper lockout and maintenance tagging of circuits and plant items to ensure the safety of personnel and the security of the system
h) The SA system shall use open communication protocols and be readily interfaced with third part devices operating on open protocols (IEC61850, IEC60870-101/104).

The Tenderer shall describe such interfaces and provide an experience list of devices with which the offered control system has previously been interfaced.

i) The integration works of the SAS to existing SCADA System shall not be included in the scope. However, the contractor shall provide and clearly label all the required signals and commands for Telecom and SCADA integration at the control panels' Terminal Block.

Station Level

At station level proposed SAS shall typically include but not limited to following features:

a) 2 Independent Gateways (Main and Hot-standby) for communications to the SCADA system
b) Configuration and parameterization software with onetime licenses fully paid.
c) 1 Operator Workstation/HMI-OWS, and the complete workplace (desk, chair & File cabinet).
d) 1 Engineering Work Station-EWS (Industrial) to be installed in Panel.
e) Color printer. To print screen shots
f) Satellite clock, complete with GPS Receiver, Antenna and necessary time synchronization ports.
g) Interface for laptop computer for maintenance, information transfer and emergency HMI
h) Laptop Computer for maintenance, information transfer and emergency HMI
i) UPS system for SCMS/ SAS (including OWS, EWS and Printers).
j) Communication network equipment [station (system) LAN, Field Communication Network, Various optical couplers, etc.].
k) Interface for control and monitoring of the circuit/bay.

SCADA Interface

a) 1 (one) lot complete system (equipment and software), with communication gateway, data concentrator etc. for interface to a regional (RCC) SCADA system and to the national (NCC) SCADA system. using IEC60870-101/104 protocols.
b) The integration works of the SAS to existing SCADA System shall not be included in the scope. However, contractor shall implement stage three (3) of Scada and telecommunication system i.e. testing to ensure all substation level signals and commands are received at NCC or RCC for the purpose of KPLC integration.
c) Contractor shall provide and clearly label all the required signals and commands for Telecom and SCADA integration at the Control panels' terminal block.

4.2.2.3.2.2 Substation Automation System (SAS) for 33/11kV substation with 2.5 MVA transformer and up to 7.5 MVA transformer.

a) The system scope shall include detailed system design, manufacture, supply, installation, testing, and commissioning of SAS system comprising of:
b) 1 (One) RTU (Gateway switch) fully wired functional panel with all necessary accessories
c) 2 (two) Multiplexer (Switch IP620) with Ethernet LAN switches. One for main station and another for integration with RCC.
d) Set of SFP modules necessary for integration with existing SAS system Multiplexer
e) Set of patch cords and ethernet cables necessary for bay interconnections.
f) 110 to 48Vdc voltage converter for RTU auxiliary supply.
g) At station level the SAS system shall not have HMI Work stations for control and operation

SCADA Interface

The integration works of the SAS to existing SCADA System shall not be included in the scope. However, contractor shall implement stage three (3) of Scada and telecommunication system i.e. testing to ensure all substation level signals and commands are received at NCC or RCC for the purpose of KPLC integration.

4.2.1.11.3 Control and Measuring Cables

All external cables, conventional or fibre optical, for control, protection, measuring, indication, etc., for the complete plant shall be included. Wiring between the switchyard apparatus, transformers, the board(s) and the control system in the control building and the interconnections between the various apparatus in the switchyard shall be included.

4.2.1.11.4 Telecommunications

The system shall have telecommunication based primarily on Fiber (OPGW and ADSS) multiplexers and on some cases Base radio stations shall be established linking various equipment in substations to Regional Control Centers (RCCs). It shall include all necessary equipment in substations and Control Centers as described in varies sections of work scope under telecommunication.

In order for the SCADA data to be transferred to the Regional Control Centers, the bidder shall design and commission an appropriate communication system based on Fiber, PLC, Radio or other approved communication media for data and speech requirement.

Equipment supplied shall be digital and latest technology and shall comply to the latest ITU-T, IEC, ITU-R, IEEE and ETSI standards.

It is required that one remote subscriber be implemented in each substation.
Interface for data transmission shall be according to ITU-T recommendation V.24 or V.35
Bit error rates of 1x10-6 shall not be exceeded.

It is the responsibility of the contractor to interconnect with existing SCADA and Telecommunications system. However, use and extension of existing infrastructure where possible shall be encouraged.
The Tenderer shall acquaint himself with all the sites and determine the requirements for towers or masts to suit his design. When a new tower or mast is necessary, the contractor shall supply drawings for the proposed installation. All towers shall be 36 m and self-supporting. The contractor shall provide details of loading and guy stresses for masts or towers to be erected on buildings. All antennae mounting components including wave-guides, cables, cable clamps and external cable connectors shall be specified.

All communications equipment installed in the country must be type approved by the Communications Authority of Kenya (CAK). The Contractor will obtain the type approval. The CAK has to be consulted and give approval for each new project and an application has to be submitted stating the location of the sites and request for the frequencies to be used. Unless otherwise stated this application for frequencies is normally done by KPLC.

The radio frequency plan shall be prepared by the Contractor and closely coordinated with

KPLC during the project design stage. All path surveys shall be carried out by contractor.
The Contractor shall provide a list of recommended spares, the quantities and prices to last for a period of five (5) years after expiry of guarantee period.
The contractor shall offer training for five (5) technical appointees of the employer for 2 weeks at manufacturer's premises.
The contractor shall provide necessary configuration software pre-installed on a maintenance laptop with a one-time software license.

Scope of works - Telecommunication

a) The scope for 132/66/33/11 substation with a 10 MVA transformer and above shall include detailed system design, manufacture, supply, installation, testing, commissioning, remedying of defects, maintaining the works during the defects liability period and any incidental work necessary for the proper completion of the work in accordance with this contract.
Scope shall include integration of STM-1/4 and IP phone system to the existing KPLC Network Management System. In some cases, there shall be need to upgrade existing telecommunication equipment to achieve data and speech routing to regional and national control centers. Survey and necessary preparation work on existing systems, equipment and substations to achieve specified functionality shall be in the scope of supply. All stations shall be equipped with two (2N0.) IP telephones extensions communicating with RCC and NCC via fibre optic.
All communication equipment supplied under this project shall be type approved by the regulator, Communication Authority of Kenya (CAK) and the Kenya Bureau of Standards (KBS) where applicable. It is the responsibility of the contractor to obtain these necessary approvals.

b) The telecommunication system scope for 33/11kV substation with a 2.5MVA transformer and below shall be achieved by installation of 2-way Base radio station and integrating it to region control centers or as shall be specified in the defined scope of work or in the bill of quantities for equipment.

Minimum technical requirement for a 2-way base radio station are summarized below:

Specifications for VHF 2-Way Base Radio station

No	Description
1	Motorola base station AAPX 2500 digital Vhf Radio Freq;138-150MHZ or its internationally equivalent type. *Flash port code:* Complete with:12 to 20Vdc PWR cable, desk microphone, desk tray etc.
2.	Fiberglass: Collinear base station Omni-directional 3db antenna 138-150MHZ range
3.	30 Meters Rg 213 Coaxial cable
4.	Mini-UHF Crimp type connector to N-MALE RG213, 2Mtr RG58 N-Male/Mini-UHF pigtail Jumper
5.	Power Supply Unit/Battery Charger
6.	RS-232 Programming cable or equivalent type
7.	Most current Programming software
8.	75 or 70Ah 12V DC Free maintenance battery
9.	6 Meter 1-1/2 Galvanized pipe complete with support arms brackets for mounting antenna

4.2.1.11.5 Auxiliary AC supply equipment

I. Main AC Distribution Board

1 (one) main distribution board designed for minimum 250A rating with necessary number of panels and accessories as indicated below:

a) Auto Change Over scheme for two 3-Phase 415Vac supply sources to be incorporated in the board for 23MVA substations capacity and above
b) 2 (two) circuit breaker and busbars minimum rating of 250A, manual and auto operated for each incomer from the station supply transformers.
c) 2 (two) current transformers 250/1/1A with two cores, one core for measuring and one for protection.
d) 1 (one) constant time overcurrent and Earth fault relay.
e) 1 (one) A-meter function with selector switch for each incomer.
f) 1 (one) V-meter function with selector switch for each incomer.
g) 1 (one) lot of feeder Miniature Circuit Breakers with electro-magnetic and thermal releases. The breaker ratings shall be chosen to suit the different consumers to be connected. 20% of the breakers of each size shall be spare and readily mounted.

II. Sub-distribution Boards and Panels

1(one) lot of all necessary sub-distribution boards and panels (including the distribution panel for lighting and small power of the control building). The boards shall be completely equipped with correct rate copper bus bars, MCBs, Fuses etc. Contactors, motor starters, instruments, operating switches, push buttons, indicating lamps, etc., shall be included whenever required. 20% of the breakers of each size shall be spare and readily mounted.

III. Cables

1 (one) lot of all necessary armored (steel wire) flexible copper power and control cables for supply to the main distribution board and to the sub-distribution boards, panels and equipment except for the cables for lighting and small power which are included in the civil Goods under separate contract.

4.2.1.11.6 DC Supply System

I. Vented Nickel-Cadmium (Ni-Cad) Batteries

a) 1 (one) 110 V battery bank with a capacity of at least 165Ah/10h for 66/33/11kV substations.

b) 2 (two) 110 V battery banks with a capacity of at least 265 Ah/10h each for 132kV and 220kV substation.

c) 1(one) 48V battery bank with a capacity of at least 100 Ah/10h for telecommunication equipment and SCADA for 66/33/11kV substations

d) 2(two) 48V battery banks each with a capacity of at least 200Ah/10h for telecommunication equipment and RTU for 132kV and 220kV substations

The battery capacities shall be based upon the calculated consumption considering a full developed substation, with the above minimum ratings.

Batteries shall be installed in separate room with proof ventilation fan and independent door opening from outside.

II. Charger System

(a) 1 (one) DC charger for each 110V battery bank.
(b) 1 (one) DC charger for each 48V Battery bank.

The chargers shall be complete with instruments, MCBs on AC and DC supply side and protection. The chargers shall have auxiliary contacts for collection of status, alarms and measurands signals for the SCADA system.

Note 1: *The battery and Charges shall meet KPLC, IEC specifications and general requirements*

Note 2: *If the DC System ratings in the* ***attached KPLC specifications*** *differ with the values given in the scope for the works, the* ***parameters*** *in the scope of works shall apply(prevail).*

III. Distribution Board

1 (one) Distribution Board 110VDC and 48VDC system
The board shall be installed with following equipment amongst others:

a) 1 (one) appropriately rated circuit breaker with magnetic and thermal release for each feeder from the charger and battery.
b) 1 (one) appropriately rated tie breaker for each DC bus in the stations with 2 (two) battery banks.
c) 1 (one) A-meter with shunt for each battery bank.
d) 1 (one) V-meter with selector switch for the voltage between the poles and between poles and earth for each battery bank.
e) 1 (one) set of contacts on the front for banana jacks for the battery voltage and earth.
f) 1 (one) battery monitoring devices with alarm contacts.
g) 1 (one) lot of all necessary circuit breakers and miniature circuit breakers for the outgoing feeders and circuits.

20% of the breakers of any size shall be spare and readily mounted.
All necessary materials and instruments required for complete functioning of the DC supply systems.

IV. Battery Conductors and Fuses

a) 1 (one) set of single core conductor from each battery bank to the associated DC Chargers.
b) 2 (two) single pole fuse boxes for the batteries, placed on the wall inside the battery room.

V.Sub-distribution Boards and Panels

1 (one) lot of all necessary sub-distribution boards and panels for the DC systems.

The boards shall be completely equipped with bus bars, miniature circuit breakers, fuses, etc. Contactors, motor starters, instruments, operating switches, push buttons, indicating lamps, under-voltage relays with alarm contact, etc., shall be included whenever needed.

VI.Cables

1 (one) lot of all necessary DC power supply armored copper cables and associated materials, including wiring to the apparatus in the switchyard.

4.2.1.11.7 Earthing System

An Earthing network shall be installed comprising the following:

(a) 1 (one) lot of underground Earthing system covering the platform and control building with risers.

(b) 1 (one) complete set of "above-floor" earthing system for the control building, as applicable, with connections to the risers from the under-ground system.

4.2.1.11.8 Ancillary Equipment

The following ancillary equipment shall meet KPLC technical specifications:

I. Station Equipment

a) 2 (two) self-contained, rechargeable, portable hand-held lights.

b) 1 (one) audible alarm system with the necessary wiring.

c) Emergency lighting to be provided in the substation building.

d) 1 set of fire detection system in the control building

II. Earthing Devices

(a) 1 (one) set of three phase portable Earthing harness for outdoor 11kV up to 132kV with operating rods/link sticks suitable for Earthing of the bay conductors and bus bars.

(b) 1 (one) set of voltage indicators for 11kV and 132kV with audible and visual indication for voltage

III. Cable Accessories

1 (one) lot of all connecting material, cable boxes and material for fixing the cables. Terminals, glands and terminal labels shall be included in the material requirement

IV. Racks, Conduits, Ducts, etc.

a) 1 (one) lot of all cables racks and trays, conduits etc. to the extent necessary for the proper distribution of cables.

b) All the conduits and protection tubes, wherever cables may deteriorate or where cable laying may otherwise present difficulties during installation.

4.2.1.11.9 Power transformers

To be supplied as specified for each substation, and in accordance with below data

Main data for the transformers that shall be supplied:

Pos.	Rating MVA (ONAN/ONAF)	Voltage	Tapping range	OLTC
1	35/45	132/66	±8 x 1.67%	Yes
2	35/45	66/11	±8 x 1.67%	Yes
3	18/23	132/66	±8 x 1.67%	Yes
4	18/23	132/33	±8 x 1.67%	Yes
5	18/23	66/11	±8 x 1.67%	Yes
6	18/23	33/11	±8 x 1.67%	Yes
7	7.5/N.A	33/11	±8 x 1.67%	Yes
8	2.5/N. A	33/11	± 2 x 2.5 %	No

Type of transformers

- **Coastal region-** shall be of vector group: Ynynd1 (with stabilizing winding).
- **Mt Kenya region & Nairobi region –** shall be of vector group: Dyn1
- **West Kenya region –** shall be of vector group: Dyn11

4.2.1.11.10 Civil Works

Platform Works.
Platform, equipment foundations, plot perimeter wall, earthworks, cable trenches, roads and drainages shall be constructed as specified in Particular Technical Specifications for civil works.

Switchgear Buildings
Switchgear buildings shall be constructed as specified in particular specifications for switchgear building.
Control Panels, Medium voltage indoor switchgears, AC and DC systems of different Voltage levels shall be installed in separate rooms.
In addition, a guardhouse with toilet facilities located at the main gate shall be constructed.

Power Transformer and Equipment Foundations
The power transformer and equipment foundations shall be constructed as specified in particular specifications for civil works.

Cable Trenches
Cable trenches shall be constructed as specified in Particular Technical Specifications for civil works.

4.2.1.11.11 Training in Major Equipment

The training shall be for 5 (five) KPLC engineers for each of the courses indicated here in. The training shall be held at the manufacturer's factory. All training, transport costs at manufacturer's premises shall be met by the contractor. KPLC shall meet the accommodation costs.
The training shall cover design, application, testing, commissioning and maintenance of the relevant digital control and protection systems.. The training shall be biased towards principles of substation design, equipment Construction & installation, RTU, Telecommunications Control and Protection and Contract management. The training course shall have a minimum of 2 (two) weeks duration

4.2.1.11.12 Factory acceptance test

The Contractor shall arrange for 2 participants from KPLC and the Project Manager to witness tests of major equipment listed below in the manufacturer's plant. All routine tests shall be carried out in the presence of the Employer's representatives. The Contractor shall arrange for the FAT and meet full cost of the air tickets, local transport, training at manufacturer's factory and *per diem* for KPLC staff. as per SRC rates or KPLC designated rates; whichever is higher.

The Major Equipment includes:

a) Circuit breakers
b) Protection and control system
c) Transformers
d) Power Cables and Conductors
e) Instrument transformers
f) Disconnectors
g) SAS and Telecommunication System
h) Insulators and Surge arrestors
i) Concrete Poles and Towers
j) OPGW/ADSS
k) DC System
l) Substation Steel Structures

FAT shall be carried out as prescribed in the particular technical specifications.

4.2.1.11.13 Commissioning Equipment or Tools

Laptop computers: Two pieces per Lot, installed with comprehensive software. The PC shall be supplied with all the necessary accessories and ports and loaded with latest operating system. The laptop must be able to run all the relay and equipment software's supplied under the contract. The lap top specifications shall be approved by the project manager.

4.2.1.11.14 Final documentation

a) Witnessed and signed commissioning site acceptance tests. 3 (three) hard copies and 1 (one) soft copy.
b) As built drawings in 4 (four) paper copies delivered in box files as approved by project manager; and three (3) Soft copy in flash drive (all drawings in AutoCAD and PDF)
c) Operation and maintenance manuals in 3 paper copies delivered in box files as approved by project manager and 3 (three) soft copy in flash drive
d) Installation software and configuring files for all SAS, telecommunication system and protection equipment and a copy in hard drive. 2 (two) soft copies
e) Back up for the system and files, including all the above soft copy files in hard drive (HDD)

4.2.1.11.15 Facilities for the Kenya Power Management Team

I. Site Offices

At the location where the Contractor will establish his main site, an administration office for site supervisors from the Project Manager with basic office furniture, drinking water, internet, telephone and a copier shall be provided by the contractor for the entire project implementation period.

II. Communication Facilities

The contractor shall supply 3 Nos. pre-paid phone and Airtime equivalent to KES3,000/= per month for the KPLC Project Implementation team for the entire project implementation period. The communication facilities are subject to approval of the project manager.

III. Drawing approval and Commissioning Laptops

The contractor shall supply two (2) Laptops per lot for design approval and substation protection & control and SAS commissioning. 2No. commissioning laptop shall be pre-installed with IEDs testing and configuration software/backup files for SAS, Control &Protection IEDs. Application software shall be running on most recent MS window 64-bit OS, Intel core i7 with unlimited licenses period. The Design approval laptop(s) shall be pre-installed with MS application packages, AutoCAD, MS Project management and running on most recent MS window 64-bit OS, Intel core i7. Application software licenses shall have unlimited period. The laptops shall be subject to project manager approval.

IV. Transport for Project Implementation Team

The Contractor shall provide transport services on a 24-hour basis for use by KPLC Project Manager and his team throughout entire contract period. The Vehicle to be provided shall be double Cab, 4X4 wheel drive of at least 2400 cc engine capacity. In addition, the vehicle shall be used to provide transport services for work related to project management. It shall also be stationed/parked at KPLC premises or any other place authorized by project manager. The contractor shall bear cost of fueling, maintenance, driving etc. The vehicle shall be subject to the approval of Project manager.

4.2.2 SPECIFIC SCOPE OF WORKS

4.2.2.1 General Scope

Kipevu - Mbaraki 132kV approximately 7.0 km transmission line

Kipevu - Mbaraki transmission line works shall entail construction of new 132 kV transmission line in 223mm^2 Aluminum Conductor Composite Core (ACCC) from Kipevu II 132kV Hill-Top Substation to the proposed Mbaraki 132/33kV Substation at the KPLC Mbaraki depot. The line shall be constructed largely on Steel monopole towers with some sections on Lattice Steel Tower and Power cables.

The Monopole and Lattice towers shall be designed for three phases double 132kV and double 33kV circuits. 132kV line shall largely use the existing 33kV line wayleaves, hence existing 33kV lines shall be adapted on the transmission line towers.

Fibre Optic Ground Wire (OPGW) shall also be constructed for the entire transmission line scope. Only one three-phase 132 kV circuit shall be strung and commissioned, while existing 33kV double circuits shall be transferred/adapted to the line towers. Line towers shall be constructed complete with cross-arms and necessary hardware, ready for stringing of the second three-phase 132 kV circuit in the future.

A complete 132kV Line Bay for the Kipevu-Mbaraki transmission line shall be established by refurbishing an existing 132 kV bay and switchyard at Kipevu II 132 kV hill top substation to ensure bay equipment are installed as per KPLC specifications contained in the biding document

Line scope shall also involve adaptation of existing 11kV & 33kV Overhead lines and distribution transformers to concrete H -pole structures along the wayleave.

Civil work shall involve refurbishment of an existing control building to house line bay Control and Protection panels. Refurbishment and extension of the exiting power and control cable trenches inside the line bay switchyard and along line route.

The 132kV cables shall be installed by direct burial on the ground in some sections and use of RCC concrete trench on other sections of the line. Civil work for the cable trench shall include earthworks for direct cable burial, construction of reinforced concrete trench with covers, Micro tunneling to cross existing facilities such as tarmac roads and railways track where required. Minimum depth for direct cable burial in the ground shall be 1.8 m.

Barriers shall be constructed along the cable route to prevent damaging of the cable by heavy trucks and trailers. The barrier shall be subject to project manager approval.

Guard net shall be installed below the lines for crossing of railway lines and some highway/road sections.

Technical specifications for line design and construction requirements are detailed under Particular Technical Specifications for transmission lines.

4.2.2.2 Definite Scope of Line Work.

Scope of works for proposed Kipevu-Mbaraki 132kV single circuit transmission line shall include but not limited to the activities described below:

A total of approximately 7.0 km of 3-Phase line shall be constructed comprising of four sections based on wayleave constraints and site conditions.

1. Construction of approximately 5.2 km of 3-phase single circuit 132 kV line in 223 mm^2 ACCC conductor on self-supporting tubular double circuit monopoles towers.

2. Construction of approximately 0.3 km of single circuit 3-phase 132 kV line in 223 mm^2 ACCC conductor on two double circuit Lattice towers to cross Kipevu Creek, and one intermediate double circuit monopole tower at KPA site.

3. Installation and construction of approximately 1.5 km of 3-phase 132 kV circuit in single core 800 mm^2 AL XPLE cable. 1.0 km of this cable circuit shall be buried directly in the ground while 0.5 km will be installed in a reinforced concrete trench with reinforced cable trench covers as per KPLC Specifications

4. Adaptation and transfer of existing 33kV double circuit overhead lines to the transmission towers.

5. Refurbishment of an existing 132 kV line bay at Kipevu II 132kV hill top station to establish 132 kV line bay for the transmission line. This scope shall involve:

   a) Supply and installation of below equipment as per Section 4.2.2.2.1 (132 kV line bay).

   i) 132kV line bay and busbar extension materials similar to the existing (Conductor - 300 mm^2 AAAC and Steel support structures -Lattice angle channels)
   ii) RTU panel for line bay and integrated with the existing line bays.
   iii) Two (2) switches (IP620 Ethernet switches). One for Line bay station and another for integration with RCC.
   iv) Splicing existing fibre optic cable and installation of ODF and associated equipment.
   v) Set of patch cords and ethernet cables necessary for station integration.
   vi) Steel support structures for 132kV cable take-off sections.
   vii) Line bay outdoor equipment and associated materials
   viii) Materials for connection of auxiliary supply from existing AC distribution board

   b) Modification, demolition and construction of platforms for line bay equipment at an existing switchyard
   c) Modification and extension of existing HT and control cable trenches, complete with cable trench covers similar to existing ones.
   d) Repair and extend approximately 50m front section of the existing chain link fence. (Supply and install new chain link fence using existing AL posts and a new gate meeting KPLC substation gate specifications)

6. Installation of OPGW earth wire and underground fibre Optic underground cable together with the transmission line.
7. Transfer of the existing distribution transformers on the wayleave trace to concrete H-pole structures.
8. Refurbishment of existing Control building at Kipevu II 132kV hill top station to house indoor equipment. The scope shall include below works.
   a) Extension and rehabilitation of existing cable trenches in and around the control building.
   b) Partition battery room, create access door and install AL glass door between the two CRP rooms.

c) Modification of existing Al glass window and installation of new window for the partitioned room
d) Installation of fire detection and suppression system.
e) Repair to make operational the existing air conditioning system
f) Install exhaust fan in the new created battery room
g) Any other necessary repair work (wall and floor) that may be required to make the building ideal for housing of indoor equipment.

9. Installation of monopole and lattice towers, power cable, conductor, line fittings and 132 kV line bay equipment
10. Supply of materials for transfer/adaptation (fittings and accessories) of the existing 33kV double circuit lines to the monopole towers.
11. Installation of RTU Panel and integration with existing Scada system.
12. Coordination of new 132 kV line bay protection and control schemes with existing protection and control system.
13. Route clearance and Construction civil work for tower foundations and cable trenches.
14. Towers along busy roads and trailers' parking areas shall be adequately barricaded to prevent damage by heavy trucks and trailers.
15. Transmission line route survey and geotechnical investigation
16. Transmission tower, Lines and substation design work
17. End to end system testing and commissioning as per KPLC standards.
18. MV and LV line transfer and configuration/rearrangement of existing circuits to create wayleave space for the transmission line. The scope shall involve:

a) Rearrangement and Conversion of approximately 1.0 km of existing 33 kV O/head lines to underground cable circuits (Single core 300 mm^2 AL XPLE cable)
b) Rearrangement and Conversion of approximately 1.5 km of existing 11kV O/head lines to underground cable circuits (3/Core 300 mm^2 AL XPLE cable)
c) Transfer of approximately 0.5 km of LV (0.42 kV) overhead line to existing line concrete poles

4.2.2.3 Specific cable installation works scope requirements

4.2.2.3.1 132 kV Underground Cable installation requirements along road reserve, surface ground and in reinforced concrete trench.

1. The 132 KV Power cable shall cross various facilities (roads, gas pipes, water pipes and railway) as described below.
   a) Road crossings: Approximately 6 (six) crossings
   b) Railway crossings: Two (2) crossings at ground railway track
   c) Facility crossings: Total approximate distance of 100 m:
      i) LPG gas pipe: One crossing point
      ii) Main water Pipe: Two crossing points
      iii) Water foam pipe for fire hydrant: One crossing point

Note: *These crossings are for bidding guidance only and may change during contractor's detailed geotechnical survey. Contractors are advised to gather enough and accurate data during pre-bid site visit*.

2. The 132KV cable shall be installed largely by direct burying, along proposed line route: Kipevu complex, Kismayu, Shimanzi roads, and other areas. The installation shall be as specified under Particular Technical Specifications for civil and power cable works and elsewhere in the scope of work requirements.

3. Cable installation along and across specific facilities on the proposed route shall be carried out as described below in conjunction to other requirements in particular technical specifications for civil works and underground cable.

4. Scope of existing 33kV double circuit transfer/adaptation to the transmission line towers shall not involve grounding of these lines

4.2.2.3.2 132 kV Power Cable laying in reinforced concrete trench along roads.

1. Where the cable is to be installed along the road reserve with limited space it shall be laid on reinforced concrete (RCC) cable trench of adequate dimension and shall be adequately drained. Minimum depth and width of the trench shall not be less than 1500 mm.

2. The concrete cable trench shall have heavy reinforced concrete slabs or covers and shall use corrosive resistant Portland pozzolana cement with minimum strength of 42.5 kN/m2.

3. The cables trenches shall be adequate to accommodate double circuit cables with a spare capacity of 15 % for future use.

4. Top of the cable trench shall be not less than 150 mm above the finished ground level, to prevent flooding of the cable trench.

5. Appropriate barriers of right grade and size subject to approval by project manager shall be installed along entire length of the cable trenches to prevent damage by heavy trucks and trailers.

6. Horizontal separation distance between cable trench and other parallel existing service installations shall be at least 600 mm except for gasoline and LPG pipes that shall be 1000 mm.

4.2.2.3.3 132 kV Power Cable laying across ground railway tracks and tarmac roads.

1. Where power cable is to cross ground railway tracks and tarmac roads installation shall be by horizontal directional drilling for that section across the facilities.

2. The bored hole shall be at least 3000 mm beyond outer rail line or 3000mm beyond the toe of embankment, whichever is further away.

3. Across the roads drilled hole shall emerge not less than 3000 mm from the end of road edge.

4. Heavy duty GI anti-corrosive treated pipes of at least 10 mm thick shall be pulled through the bored hole, Power cable shall then be installed inside the GI conduit. The diameter of the bored hole shall not exceed outside diameter of the pipe by more than 50mm.

5. Depth of bored hole from the surface shall be as per Kenya railway Corporation and Kenya Road Authorities requirements/guidelines. However, in any case minimum depth of the bored hole from the surface ground level shall not be less than 1500 mm.

6. The complete installation shall be constructed in such away to be able to withstand weight imposed on it by crossing trains, trailers, Lorries and earthmovers without collapsing of the bored hole.

4.2.2.3.4 132 kV Power Cable laying crossing Gasoline /LPG, Water and Foam pipe Services.

1. Cables shall be laid in a heavy reinforced concrete (RCC) cable trench, with a clearance that meets the minimum requirements of existing other services.

2. Cable trench shall be of adequate dimensions and well drained. The Concrete trenches shall have reinforced concrete slabs or covers and shall use corrosive sulphate resistant Portland or pozzolana cement with minimum strength of 42.5kN/m2. Concrete trenches shall be adequate to accommodate double circuit cables with a spare capacity of 15%.

3. The cables trench wall thickness and floor shall be subject to approval of the project manager.

4. Cable trench shall be provided with a layer of clean, dry sand bend of not less than 150mm in depth, before laying the cables. Cables shall also be covered with clean sand after laying. Thickness of the sand shall not be less than 100 mm on either side of cable trench and 150mm on top of the cables.

4.2.2.3.5 132 kV Power Cable laying Cross underpass rail track along and Overpass foot bridge.

1. Power cable shall cross underpass railway track alongside overpass railway foot bridge on stainless steel perforated heavy gauge cable trays or prefabricated GI steel bed designed and constructed as per project manager's approval. Cable trays shall be installed complete with tray covers. Cable trays and covers shall be coated with an approved anti-corrosion compound.

2. Cable tray shall extend at least 3000 mm from edge of the bridge embankment, where the cable shall enter the concrete cable tray or start direct burying.

3. Cable tray shall be fabricated out of slotted/perforated stainless steel sheets as channel sections. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. The minimum thickness of the perforated sheets shall be at 3.0mm.

4. The cable trays shall be adequate to accommodate double circuit cables plus 15% additional width for future expansion.

5. Horizontal separation distance between the cable tray and other existing service installations on the overpass bridge shall be as per minimum requirements of each service.

4.2.3 BILL OF QUANTITIES FOR THE TRANSMISSION LINE AND LINE BAY.

The bill of material quantities for the lines and substation associated works shall include but not limited to below items. It is the responsibility of the Bidder to ensure all the materials required for complete functioning/operation of components and complete system are included in the BOQ and costed correctly.

4.2.3.1 Kipevu - Mbaraki 132kV Single Circuit transmission line bill of quantities

Item	Item Description	Unit	Qty
LINE MATERIAL AND EQUIPMENT			
KTL-101	132 kV three-phase transmission line circuit in 223 mm^2 ACCC conductor on Monopole towers complete with line fittings, insulators and all other necessary hardware	Lot/km	5.5
KTL-102	3-Phase cable circuit in 132 kV 800 mm^2 S/C AL cable complete with termination kits, jointing kits, sealing ends and surge arrestors	Lot/km	1.5
KTL-103	Steel structures support for 132kV cable transition to Overhead line	Lot	I
KTL-104	Multi-circuit monopole towers and associated hardware	Lot/km	5.2
KTL-105	Multi-circuit lattice towers and associated hardware	Pc	2
KTL-106	Earthing system for transmission line towers	Lot	1
KTL-107	96 cores single mode OPGW cable complete with fittings, splice boxes and associated hardware fittings	Lot/km	5.5
KTL-108	96 Cores single mode FO underground cable complete with associated hardware materials	Lot/km	1.5
KTL-109	Materials for 132 kV underground cable installation along and crossing of bridges, railway and road	Lot/km	0.5
KTL-110	Materials for overhead line guard net for facility crossing	Lot/km	1
KTL-111	Materials for transfer/adaptation of 33kV double circuits overhead lines to the transmission line towers	Lot/km	4
KTL-112	33 kV S/Core 300 mm^2 AL cable complete with terminations, jointing kits, surge arrestors and line hardware	Lot/km	1
KTL-113	11 kV 3/Core 300 mm^2 AL cable complete with terminations, jointing kits, surge arrestors and line hardware	Lot/km	1.5
KTL-114	Materials for transfer of LV existing circuit to 11/33KV overhead lines on concrete poles	Lot/km	0.5
KTL-115	Materials for transfer of the existing distribution transformers to HP concrete poles	Lot/Pc	4
132 KV Line Bay equipment at Kipevu II Station			
KTL-116	132kV Motorized Line isolator without Earth switch	Pc	1
KTL-117	132kV Motorized Line isolator with Earth switch	Pc	1
KTL-118	132kV Circuit breaker with single Pole mechanisms	Pc	1
KTL-119	132kV Current transformers	Pc	3
KTL-120	132kV Voltage Transformers	Pc	3
KTL-121	132kV Surge Arresters	Pc	3
KTL-122	132 kV Line Protection panel (Main A and Main B)	Pc	2
KTL-123	132 kV Line Control panel with BCU	Pc	1
KTL-124	132 kV Line bay and busbar materials including post insulators	Lot	1
KTL-125	Line bay and equipment steel supports structures similar to existing type	Lot	1
KTL-126	Telecommunication system integration equipment (Multiplexer type SDH STM-4, associated materials, Patch cords, Cards etc.)	Lot	1
KTL-127	SCADA line bay RTU panel and associated materials	Lot	1
	110V/48V DC to DC converter	Pc	2

KTL-128	Material for extension of Earthing and Lightning protection system	Lot	1
KTL-129	Materials for extension of Switchyard lighting system	Lot	1
KTL-130	Material for supply of bay equipment form existing 110V DC distribution board	Lot	1
KTL-131	Materials for auxiliary supply from existing AC distribution board	Lot	1
KTL-132	Fire detection and suppression system	Lot	1
KTL-133	Repair/replacement of existing Air condition system to make operational	Lot	1
KTL-134	Multicore control and measurement cables	Lot	1
Mandatory Spares and Tools			
KTL-S01	Suspension Monopole tower (same type as ones supplied)	Pc	2
KTL-S02	Tension tower (30-45^{O}C) (Same type as one supplied)	pc	2
KTL-S03	132kV S/Core 800 mm^2 sealing end kits, termination and Jointing kits (2 Sets each)	pc	18
KTL-S04	Bay Control and Protection Unit (BCPU)	Pc	1
KTL-S05	Line differential IED (Relay)	Pc	1
KTL-S06	Circuit Breaker trip and close Coils (2 Nos. each for 132 kV CBs)	Pc	4
Design Works			
KTL-301	Transmission line design (Electrical, Mechanical, Civil, Control and Protection)	Lot	1
KTL-302	Transmission line route survey and Geotechnical Investigation	Lot	1
KTL-303	Transmission line tower design	Lot	1
KTL-304	132 kV Line bay station design (Electrical, mechanical, Civil, Control/protection, telecommunication and SAS)		
Line Works			
KTL-401	Line route clearance and tower foundation Civil work	Lot/km	5.5
KTL-402	Transmission line tower erection and dressing work	Lot/km	5.5
KTL-403	Transmission line stringing and commissioning	Lot/km	5.5
KTL-404	132kV Cable Circuit route clearance and related civil work	Lot/km	1.5
KTL-405	132kV Cable Circuit installation and commissioning	Lot/km	1.5
KTL-406	33 KV DC line transfer/adaptation to the transmission line towers	Lot/km	4
KTL-407	Installation and of POGW and FO approach cable	Lot/km	7
KTL-408	Transfer/adaptation and rearrangement of existing 33/11/0.420 kV lines and distribution transformers to create space for transmission line	Lot/km	2.5
KTL-409	Transfer of existing LV (0.42 kV) overhead line to existing line 33/11KV concrete poles	Lot/km	0.5
KTL-410	Transfer of existing distribution transformers to H-Pole structures	Lot/Pc	4
Line Bay Station Works			
KTL-411	Switchyard refurbishment-Earth work (excavation, back filling, compaction, ballasting etc.)	Lot	1
KTL-412	Platform refurbishment– Equipment foundations and associated work	Lot	1
KTL-413	Refreshment of existing drainage system	Lot	1
KTL-414	LV Cable installation work	Lot	1
KTL-415	Steel structures erection work	Lot	1
KTL-416	Equipment (Indoor and Outdoor) erection and installation	Lot	1
KTL-417	Equipment (Indoor and Outdoor) testing and commissioning	Lot	1
KTL-418	SAS and Telecommunication system installation and commissioning		
KTL-419	Integration of Line bay protection and control system with existing Kipevu 132/33kV protection and control system	Lot	1
KTL-420	SAS integration with existing RCC system	Lot	1
KTL-421	Refurbishment and extension of existing cable trenches	Lot	1

KTL-422	Refurbishment of CRB, Partitioning of battery room and installation of new doors and windows	Lot	1
KTL-423	Refurbishment of Switchyard lighting	Lot	1
KTL-424	Repair and extend front section of the existing chain link fence with a new chain link using existing AL posts and a new gate	Lot/m	50
KTL-425	Extension of Switchyard Earthing and Lightning protection	Lot	1
KTL-426	Facilities for KPLC Project implementation team (Site office, Communication and transport services)	Lot	1
KTL-427	Cost of GoK statutory approvals	Lot	1
KTL-428	Cost of work site ESHS activities	Lot	1
KTLT-01	Factory and Acceptance test (FAT) for Line materials and equipment	Lot	1
KTLT-01	Training on monopole installation and line maintenance	Lot	1

4.2.3.2 Transmission Line ESHS Activities

The contractor shall implement the following worksite key ESHS activities in addition to any other environmental, social, health and safety (ESHS) activities required in the works specifications.

Cost of ESHS activities shall be deemed to have been included in the pricing of substation and lines works. No separate price schedule is required for ESHS scope.

Transmission Line ESHS Work Activities	
ESHS 01	**Air pollution management (Noise and dust control)**
	Suppress dust during dry periods by watering areas/Cover stock piles of soil
ESHS 02	**Solid waste generation**
	All solid waste management and disposal, including provision of Pit latrines/Portable toilets and sanitary materials
ESHS 03	**Traffic control and management**
	a. Management of traffic to ensure safety and minimise jam during line construction
	b. Liaising with Traffic control subcounties agencies for approval of road closures and supervision during line stringing.
ESHS 04	**Occupational Health & Safety at worksite**
	a. Training local workers and subcontractors on ESHS issues and creating awareness to the workers on social and health issues.
	b. Creation of HIV & AIDS awareness, and provision of materials for control and prevention to the workers in collaboration with county government health agencies
	c. Provision of water for drinking, handwashing and soap. Provision of hand sanitizers in worksite offices
	d. Maintain a fully stocked and accessible first aid kit and trained first aider.
	e. Provision of appropriate PPEs (Clothing and equipment for all workers at site)
ESHS 05	**Public health and safety**
	Proper securing of worksite to control access, and hazard communication to the public by use of appropriate warning signages
ESHS 06	Local stakeholder/leaders and community engagement to create conducive environment for project implementation