

# **Terms of Reference for Consulting Services for Transmission System Planning, Feasibility Study and Project Preparation**

## **1. Background and Definitions**

- 1.1 Malawi is a developing country and urbanization as well as industrialization is rapidly increasing. The energy consumption is increasing at a very high pace across the country. Power generation and transmission is also growing accordingly. Electricity Supply Corporation of Malawi (ESCOM) is making all efforts on supplying quality and reliable electricity supply at affordable price to its consumers. ESCOM is also initiating the demand drive programs to increase electricity consumption as such the energy generated from the power producers throughout the country wouldn't spill and be used efficiently. Existing capacity of transmission lines and substations across the country will not be sufficient to meet the growing energy demand and peak demand in the future which lead to upgrade the capacity of existing transmission lines and substations as well as to plan and construct new transmission lines and substations in different phases.
- 1.2 The power transmission infrastructure requires lots of land and Right of Way (RoW) along the line. It is very hard to find the land and RoW in the cities to construct transmission line and substations. In the future the problem of land and RoW will be more critical; hence ESCOM has decided to plan the transmission infrastructure considering the future demand of electricity till 2063 and develop the infrastructure accordingly in phase wise.
- 1.3 It is also high time to find some alternatives to avoid land and RoW problems in transmission infrastructure by adopting the modern practices like Underground transmission system, transmission system using monopoles, construction of compact Gas Insulated Substations (GIS) etc.
- 1.4 In support of the Government of Malawi's (GoM) energy development goals, ESCOM has provided in its budget funds which will support for Power Transmission System Planning for the year of 2063 including the Feasibility Study and Project Preparation of Transmission System Expansion for the major cities of Blantyre, Lilongwe, Mzuzu and other districts.
- 1.5 The Power Transmission System Planning for the major cities and all other districts taking into account of the future load growth till 2045 including their Feasibility Study and Project Preparation shall be referred as the "Transmission Master Plan Project" in this document.
- 1.6 The term "Transmission Infrastructure" shall mean the 66 kV - 400 kV Transmission Lines, 66 kV - 400 kV Substations and associated facilities to provide electricity across the country.
- 1.7 The Project aim to cover following major cities and Districts (and possible mining areas):
- (i) Blantyre city and surrounding Districts.
  - (ii) All other Districts in the South of Malawi including possible mining areas
  - (iii) Lilongwe city and surrounding Districts
  - (iv) All other Districts in the center including possible mining areas

- (V) Mzuzu city and surrounding areas
- (v) All Districts in the Northern Malawi and possible mining areas

1.8 Under this project, the consultant will be engaged in following studies and activities:

- a) Study of electricity related documents issued by Ministry of Energy, ESCOM previous Transmission System Master Plan, Distribution System Master Plan if any and ESCOM Annual Reports and collect relevant information.
- b) Data collection and preparation of demand forecasts in the Cities and Districts for the year 2030, 2040, 2050 and 2060.
- c) Study of power supply through the existing, under construction and proposed transmission infrastructures in these cities and associated industrial areas.
- d) Conduct necessary Site visits
- e) Identification and recommendation of new transmission infrastructures including reinforcement / up-gradation of existing transmission infrastructures, consultation with ESCOM and carry out further study.
- f) Carry out necessary desk study, walk over survey and field reconnaissance survey; and recommend the most suitable option for transmission line viz; Overhead Transmission Line in lattice Tower or in Monopole Tower, Concrete poles, Underground Transmission Line etc;
- g) Carry out necessary desk study, field visit and survey to recommend the suitable locations for new substation construction and accordingly recommend the type of substations in accordance with the available space viz, Air insulated Substation or Gas Insulated Substation.
- h) Feasibility study of overhead / underground Transmission line.
- i) Feasibility study of substations.
- j) Feasibility study of upgrading the capacity of existing Transmission line and upgrading/expansion of existing substation capacity.
- k) Basic design of Overhead Transmission Line, Underground Transmission Line and Substations including up-gradation of existing transmission infrastructure.
- l) Detail design of pre-stressed concrete poles to replace the existing wooden poles along 66kV Transmission lines.
- m) Preparation of Project Specific Requirements Report, current Cost Estimates, Technical Specifications, Design and Drawings, Price schedules etc; required for Bidding Documents.
- n) Economic analysis, financial analysis, sensitivity analysis and risk analysis of the Projects;
- o) Social and environmental safeguard study of the projects and recommend the impact and their mitigation measures.
- p) Preparation of Reports and Documents.

1.9 ESCOM seeks through this Expression of Interest (EOI) to engage a team of project preparation consultants through a firm to support in preparation of the Projects.

1.10 This document set forth terms of references (TOR) for the Services.

## **2. Objective:**

The overall objective is to procure a consulting service from a consulting firm for the support of developing Power Transmission System Master Plan for all major cities and other Districts in Malawi taking into account of the future load growth till 2063 including their Feasibility Study and Project Preparation.

The main objective of the Consultancy Services is to identify and recommend the least cost and economically viable new Transmission Infrastructures including reinforcement and up-gradation of existing Transmission infrastructures to meet power and energy demand of the Cities, Districts and associated industrial and mining areas for next 40 years (i.e., up to 2063).

Consultancy service shall also carry out the project preparation including surveying, feasibility study, produce necessary design and drawings, project specific requirements, cost estimation, develop technical specifications, price schedules, quality assurance plan required for preparing Bidding Documents for procurement of the projects.

### **3. Scope of the Services**

The following scope of work or services is proposed to achieve the objective of the project, which shall include but not be limited to the tasks and assignments, activities outlined below:

#### **Task 1: Inception of the Assignment**

##### **a) Collect Data, information, maps etc:**

The Consultant shall collect and review all data required to implement this assignment through review of existing reports/materials, master plans and acquisition of additional data where required to execute subsequent tasks. Except where noted, the Consultant shall acquire data through its own means (e.g. purchasing or engaging in primary data through surveys). ESCOM will facilitate engagements with other domestic stakeholders as required. These data will provide a basis for the preparation or identification of transmission line and substation planning and for the feasibility study of the planned transmission infrastructures. These data may be captured in geo-referenced form in an established Geographical Information System (GIS).

The Consultant shall provide/prepare updated topographic maps; recent satellite images, planning maps, etc., for the realization of the consulting tasks. The Consultant is responsible to acquire and prepare all GIS/mapping data necessary for the preparation of accurate maps. The GIS/mapping data shall be stored in a transferable database and shall include all relevant metadata, such as source, date of collection, coordinate system and projection, revision information, etc. The Consultant shall use the same metadata convention and GIS management approach for all GIS data necessary for this consultancy. All applicable data for all tasks of this consultancy shall be transferred to the ESCOM as necessary at the completion of the consultancy.

##### **b) Preparation of Demand Forecasts: The Consultant shall:**

- i. Collect the necessary data and information related to geographical divisions, demography, available infrastructure, socio-economic indicators, environmental and vulnerability checks, short, medium plans at national, district and municipality levels;
- ii. Investigate and report on industrial growth analysis and potential industrial sites in the cities and their demand forecasts;
- iii. Investigate and report on trends of power demand in the Cities; and
- iv. Investigate the social and economic conditions to assess the present and future electricity demand, keeping in mind affordability, willingness to pay, potential productive uses of electricity, and population growth.

**c) Desktop Identification and Evaluation of Areas for New Transmission Infrastructure and Reinforcement / Up-gradation of Existing Transmission Infrastructure**

Following on from development of the planning and prioritization process and using demand forecasts as a backdrop, the Consultant shall perform the following activities:

- i) Identify the potential sites/settlements for new transmission infrastructures (transmission line and substation) and also identify the potential existing transmission infrastructure augmentation;
- ii) Hold initial consultation meetings in Blantyre with representations from Transmission Directorate, Planning & Project Management Directorate and Regional Offices of ESCOM to discuss various aspects of transmission system planning including relevancy, course of action and choice of technologies and agree on the context and criteria for initial target site selection.

**Task 2: Project Planning & Preparation**

- a) **Review of reports and Conduct/review Network modeling and operational standards:**  
The Consultant shall review the most recent Transmission and Distribution Master Plan of ESCOM and relevant to the cities including other reports of planned and committed transmission and generation projects. The Consultant shall determine the reactive power compensation (capacitors, reactors and/or SVCs) for normal and disturbed condition of system. Some of the proposed works may involve expanding or upgrading the substations and the Consultant shall also establish load transfer schemes to reconnect the circuits to a newly expanded substation. The Consultant shall carry out all necessary analyses for transformer sizing, overhead / underground primary and secondary conductor sizing, conductor loading limits, short circuit rating of switchgears and operating characteristics etc. The Consultant shall use DigSilent for load flow and other system studies or any other recommended software to be agreed with the Client.
- b) Carry out the desk study (investigation) and walkover survey of at least three possible routes of each transmission lines:  
  
Investigate all the three possible routes and fix the optimal route alignment showing the angle points. The final and recommended route shall be so selected as to avoid or mitigate impacts to protected areas, forest areas, wildlife sanctuaries, national parks, biological resources, settlements, cultural heritage etc. The final route should avoid as far as possible earth slip zones, marshy and low lying areas, river beds, civil and military airfields, power/communication line crossings, and major rivers. Route optimization shall be carried out after careful and detail comparison of the alternative routes in regards of environmental impact, number of angle towers, proximity of access roads, magnitude of forest clearance, potential risk of local obstructions, construction difficulties, crossings (Low Voltage/High Voltage lines, communication, river, road etc.) and other relevant aspects including operation & maintenance. The Consultant shall submit the preliminary observation/suggestion along with various information collected as marked with topo sheets of scale at least 1:25000 (covering features such as road, river, canals, vegetation, forest area, monuments etc).
- c) Visit existing substations, and analyze available drawings and determine technical particulars of relevance for preparing technical specifications of equipment to be procured.

- d) The Consultant shall determine the most appropriate locations for the new substations and shall recommend the most suitable land plot (with at least three alternatives) for the substations.
- e) The Consultant shall also carry out Topographic Survey of entire substation area of each substation, covering all the features within and outside the Substation boundaries for at least a distance of 100m from the boundaries. Spot Levels- Latitude, Longitude and altitude (X, Y, Z) shall be carried out at a grid of not more than 3m x 3m size and shall be extended to cover the access road for the substation for not less than 150m and cover all natural and man-made features like earthen roads, foot tracks, natural streams, rivers, houses, electric poles, irrigation canal, drains, water body etc. Power line, if any, crossing the proposed site shall be shown clearly including the Voltage level of Power line, Type of structure carrying power line (electric metal pole/concrete pole, steel lattice tower etc.) etc. Temporary Bench Mark shall be established at Substation Site and its level from a known Permanent Bench Mark of Survey Department of Malawi with higher precision so that it will be easy during layout of Substation Structures and any other construction work. Temporary Bench Mark shall be established and marked with RCC Pillars of 100 x 100 x 300 mm size with embedment of 200mm and projecting 100 mm above the ground and shall be established no farther by 100 m from each another. Demarcation of boundary of substation sites may be done through RCC concrete pillars of 100 x 100 x 450mm size at all the sites. These pillars should be placed at all corners and at about 50m centre to centre between corners of the plot. These pillars shall be embedded in ground by excavating a pit of 300 x 300 x 300 mm and filled with PCC (1:3:6) all around. Pillars should be embedded in the ground by 300mm and should project 150mm above the ground. Development of Digital Elevation Model (DEM) shall be done based on topographic survey field data using Digital Terrain Modeling software (DTM) viz. Softwell DTM, Civil 3D etc. which shall be compatible with AutoCAD 2014 or latest package. The Consultant shall prepare Contour maps on 1:1000 scales (or any suitable scale) with contour interval of 0.5m and very steep topography 1.0 m contour interval may be adopted. Contour map shall include the clear boundary of Substation and possible feasible access road from substation site to nearest Road.
- f) The Consultant shall determine the most appropriate type of Transmission Lines; viz, Overhead or Underground, in case of overhead, in concrete, monopole or lattice tower based on the available RoW in the Cities and the cost of the line.
- g) The Consultant shall also determine the most appropriate type of Substations; viz, Air insulated, Gas insulated or compact gas insulated substation based on the available land and cost of the substation.
- h) The consultant shall Identify and group the transmission infrastructure projects be developed and commissioned to meet the energy and power demand of the cities for the year up to 2030, 2031 – 2040, 2041 – 2050 and 2051 - 2063.
- i) The consultant shall also take into account of up-gradation and expansion of transmission infrastructures to meet the power and energy demand of the Cities for the time frame as indicated above.

### **Task 3: Feasibility Study of the Planned Transmission System/ Infrastructure**

The consultant shall carry out feasibility study of the planned transmission infrastructures in details to obtain all the required information (basic design, technical specification, cost estimation, Project specific report, Price schedules etc;) required to produce bidding documents for single responsibility contracts covering design, supply and installation of plant (Standard Bidding Document for Procurement of Plant - Design, Supply and Installation that ESCOM shall be used). Feasibility study for up-gradation of existing transmission structures shall also be carried out in required details.

- A) Assess Constructability:** The Consultant shall perform an assessment of the final proposed route and tower locations through the lens of RoW requirement, available land for Substations, Cost of RoW and land acquisition, prospective of works contractors, identifying the likely equipment needed, access requirements, and corresponding production rates and labor requirements taking into account a reasonable means and methods anticipated during construction (e.g. availability of labor force, Malawi holiday schedules, road conditions, rainfall patterns, and other site access issues). This assessment shall feed into all other aspects of this assignment, including the assessment of temporary and permanent impacts like, cost estimates and work packaging and timelines.

In case of overhead transmission line, the consultant team shall prepare concrete pole, tower / monopole spotting data and the towers or monopole shall be spotted with a standard software and strength analysis for the line shall be performed. The computerized software output profile shall show the maximum sag, hot curve, ground clearance curve, weight span, wind span, adjacent span, center peg setting down etc;.

In case of underground transmission line, the consultant team shall prepare necessary key point or service points spotting data, lay out of the underground lines and any other feature deemed appropriate.

In case of upgrading of existing transmission line, the consultant shall prepare a list of all the obstacles along the right of way that may encounter during the implementation and accordingly appropriate methodology shall be developed.

### **B) Basic Design of Transmission Lines and Substations**

- i) **Conduct geotechnical investigations:** The Consultant shall carry out geo-technical investigations for the transmission towers / monopole and substations (only the existing substations which are going to be upgraded or substations for which land is already procured by ESCOM). This will require field visits along the transmission line route and to substation locations to ensure that an adequate level of technical information is available to establish the viability of proposed tower/monopole/substation locations, information required for foundation design etc; as such to minimize major changes in contract implementation in future to the respect of unknown soil/geological conditions.
- ii) **Finalize Design Standard:** The consultant shall finalize the design and operational standards recognized locally and internationally ( e.g., IEC, IEEE, IS, IBS, DIN, ATMs or other relevant standards) for technical design of transmission networks and substations, including

ensuring voltage within the required range, equipments loaded to standard levels, power factor at optimal levels, and minimum short circuit ratings for the transmission network, etc with due consideration of Grid Code of Malawi for planning and operating criteria for voltage, frequency and system overloads.

## **B1) Design of Transmission Lines and Substations**

### **B1.1) Design of Transmission Lines:**

The Consultant shall perform base engineering for the designs of the transmission line with technical specifications including design and calculations. All drawings prepared for this solicitation shall have a scale 1:1000 to 1:4000 (for linear components) and 1:100 to 1:1000 (for structures).

- (i) the Consultant shall perform the following tasks to complement other necessary tasks:
- Collection and analysis of weather/climate data including isokeraunic data in order to develop weather loadings for design of transmission line. Based on metrological data determine various loading zones for the transmission line, which shall pass through terrains with varying elevation and climate conditions, to optimize design of various transmission line elements/components.
  - Select design parameters/criteria for the transmission line (lattice tower, monopole, concrete pole, underground cable) and preparation of design manual as per relevant international standards and with reference to standards such as IEC or IEEE) The Consultant shall perform and document necessary investigations, studies, design, simulation, etc., to support the selection of design parameters and criteria;
  - Select optimum size of conductor, underground cable, OPGW; various spans values (basic span, wind span, weight spans); choice of conductors (number in a bundle, type—conventional ACSR or High Capacity Low Sag/High Temperature Low Sag or Underground Cables—based upon detail techno economic considerations), insulators and hardware and all other necessary technical features so as to conduct sag-tension calculations and prepare tower / monopole/concrete pole spotting data;
  - In case of overhead transmission line, the consultant shall optimally classify the types of foundations to be used according to the soil types and design and develop the typical foundation drawings for each type of foundation applicable for each type of tower/monopole/concrete pole (to be suitable for bidding documents).
  - **Prepare detail technical specifications:** The Consultant shall prepare detailed technical specifications along with the technical data sheet (TDS) to be included in the bidding document for steel towers, monopoles, concrete poles and accessories, foundations for all types towers, poles and soils, overhead conductor, underground cable, shield wires, optical ground wire (OPGW), Optical Fibre Cable (OFC), dampers, polymer insulators and hardware, line hardware, underground cable jointing and accessories, and all other overhead and underground line accessories including the construction materials to be used for foundation works and underground cable laying works based upon the internationally recognized standards. The design shall also include the calculations of

electromagnetic/electrostatic fields of transmission along with corona/RI. The Consultant shall carry out technical analysis to determine and demonstrate that the specifications of technical parameters chosen are realistic, optimal and suitable for Malawi-specific conditions.

- Any other tasks as deemed appropriate for the proposed overhead and underground transmission line design.

As applicable above and as deemed appropriate, the consultant shall perform all necessary design activities for up-gradation of existing transmission lines.

### **B1.2) Design of Substations:**

The Consultant shall perform base engineering for the designs of the Substations along with technical specifications including design and calculations. All drawings prepared for this solicitation shall be in an appropriate scale.

- Develop design criteria for Air Insulated Substations (AIS) and Gas Insulated Substations (GIS) calculations and technical specifications and data sheet of substations equipment (electrical, mechanical, protection and communication and control equipment) and related accessories;
- Preliminary design (suitable for bidding document) of gantry structures, equipment structures, structure foundations, control building, staff quarter, boundary wall, approach and internal roads, cable trench and associated civil works taking into consideration applicable seismic factors and preparation of all drawings;
- Prepare single line diagrams, layout and calculations, specifications and technical data sheet for HV, MV and LV equipment,
- Prepare base designs, specifications, technical data sheet, drawings and calculations of complete protection and control system including earthing system;
- Prepare base designs, specifications and drawings of substation layouts, access roads, earthing and lightning protection systems; and
- Prepare base designs, specifications, technical data sheet and drawings of SCADA, substation automation and communication and control systems and all other related document to complete the intended jobs through open competitive bidding in a single responsibility basis of contract covering design, supply and install.
- Any other tasks as deemed appropriate for the proposed Substation design.

As applicable above and as deemed appropriate, the consultant shall perform all necessary design activities for up gradation of existing substations.

### **C) Environmental and Social Assessment:**



Consultant shall assess and identify the positive and negative impacts associated with the proposed transmission infrastructures during their design, construction and operation.

Environmental and Social Assessment shall ensure the following:

- i) Environmental and social impacts associated with the project are assessed and examined at the earliest planning stage possible.
- ii) Environmental and social impacts to be investigated and examined include factors that impact the physical biological, social and economic environments (including but not limited to air, water, soils, waste, accidents, water usage, ecosystems, biota, public health, occupational health and safety.
- iii) Ensure the following safeguards compliance with relevant to policies of the country or any international lending institution:
  - Environment
  - Involuntary resettlement of the population;
  - Disturbance/Loss of livelihoods;
  - Cultural heritage;
  - Landscape;
  - Gender;
  - Communicable diseases, etc.
  - Traffic impacts should also be assessed.
- iv) Conduct IEE of the Projects planned for 2030 as provisioned in prevailing rules of GoM and get approval from the concerned authority.

**D) Economic and Financial Analysis of the Project (Transmission System Infrastructures):**

The Consultant shall analyze the economic and financial viability of the project or proposed transmission system infrastructures including the upgrading/expansion of existing ones as per International standard and norms. The consultant shall in particular perform the following major activities:

- i) Analyze the economic viability of the project. Identify all economic costs and benefits with sensitivity analyses and evaluate economic internal rates of return.
- ii) Assess and analyze the financial viability of the project. Identify all risks for revenues and costs with sensitivity analyses, and evaluate financial internal rates of return. Include risk mitigation and risk transfer plans as necessary.

**Task 4: Detail Design**

The consultant shall include at least one overhead transmission line using monopole, one lattice, concrete transmission line and one air insulated substation on their planning among any of the Cities/Districts under study and produce the detail design not limited to the following:

i. Overhead Transmission Line using Monopole: Transmission line shall be of 132 kV voltage level, double circuit with ACSR "BEAR" conductor or equivalent size. The consultant shall choose any one of the city where it is appropriate to construct overhead transmission line in monopole. The detail design shall include the following:

- Detail route alignment survey, produce profile, monopole spotting using standard software, calculate sag, hot curve, cold curve, ground clearance curve, weight span, wind span and adjacent span etc;
- Determine design parameters, calculate, design and produce drawing of family of Monopoles (with standard angles between 0 - 60 degree, dead end type and with standard extensions).
- Produce workshop drawing of monopoles.
- Geo-technical investigations along the route and soil test at necessary location of the monopole route.
- Detail design and calculation for different kind of foundations and produce drawing.
- Determine the Conductor type (ACSR or HTLS family), Insulators and Hardware.
- Prepare the technical specifications of monopoles, conductors, insulators and hardware, OPGW and other accessories related with the proposed overhead transmission line.
- Prepare technical specification of construction materials, civil works and construction methodology.
- Prepare all other necessary design to complete the specified scope of work.
- Prepare detail cost estimate of the transmission line.

ii. Lattice Transmission Line: Lattice transmission line shall be of 132 kV voltage level, double circuit. The consultant shall choose any one of the districts where it is appropriate to construct lattice transmission line. The detail design shall include the following:

- Detail route alignment survey.
- Geo-technical investigations along the route and soil test at necessary location of the lattice route.
- Detail design and calculation for different kind of foundations and produce drawing.
- Determine the Conductor type (ACSR or HTLS family), Insulators and Hardware.

- Prepare the technical specifications of lattice structure, conductors, insulators and hardware, OPGW and other accessories related with the proposed overhead transmission line.
  - Prepare all other necessary design to complete the specified scope of work.
  - Prepare detail cost estimate of the lattice transmission line.
- iii. Overhead Transmission Line using concrete poles: Transmission line shall be of 66 kV voltage level, single circuit with ACSR "BEAR" conductor or equivalent size. The consultant shall choose any one of the district where it is appropriate to construct overhead transmission line in concrete. The detail design shall include the following:

- Detail route alignment survey, produce profile, concrete pole spotting using standard software, calculate sag, hot curve, cold curve, ground clearance curve, weight span, wind span and adjacent span etc;
- Determine design parameters, calculate, design and produce drawing of family of concrete poles (with standard angles between 0 - 60 degree, dead end type and with standard extensions).
- Produce workshop drawing of concrete poles.
- Geo-technical investigations along the route and soil test at necessary location of the concrete pole route.
- Detail design and calculation for different kind of foundations and produce drawing.
- Determine the Conductor type (ACSR or HTLS family), Insulators and Hardware.
- Prepare the technical specifications of concrete poles, conductors, insulators and hardware, OPGW and other accessories related with the proposed overhead transmission line.
- Prepare technical specification of construction materials, civil works and construction methodology.
- Prepare all other necessary design to complete the specified scope of work.
- Prepare detail cost estimate of the transmission line.

iv. **Air Insulated Substation:** Substation will be constructed where adequate space is available for AIS substation. Substation shall be outdoor type, accommodate all the equipments including transformers. The Substation shall be of air insulated type, 66kV or 132 kV voltage level with two nos. power transformers of appropriate capacity. The consultant shall choose any one of the city/district where it is appropriate and required to construct air insulated substation. The detail design shall include but not limited the following:

- Develop electrical single line diagram of the substation, determine the equipments size and plan the minimum space required in the building and accommodate all (Transformer, substation switchgear equipment, control panels, Battery and Battery Charger, Feeder panels, Operators room or Control room, Fire extinguishing system, Toilet etc;) in a building.
- Geotechnical and soil investigation of the land where substation will be constructed.
- Prepare designs and drawing of substation layouts, access roads, compound walls and also prepare their technical specification.
- Determine the suitability of the type of building, i.e. Pre-fabricated pre-engineered Building or conventional type RCC structured Building. Determine design parameters, calculate, design and produce detail drawing of Substation Building, their foundation details as well as complete construction drawing.
- Prepare design and drawing Earthing system and lightning system.
- Prepare, technical specifications and technical data sheet for all substation equipment (HV, MV and LV equipment),
- Prepare designs, specifications, technical data sheet, drawings and calculations of complete protection and control system including earthing system;
- Prepare, design and drawing, technical specifications, technical data sheet and drawings of SCADA, substation automation and communication and control systems.
- Any other tasks as deemed appropriate for the proposed Substation design.
- Prepare detail cost estimate of the designed Substation.

### **Task 5: Procurement packages and Cost Estimate**

For each city/district, the Consultant shall develop a plan for project packaging and sequencing for procurement, and shall confirm the appropriate contract type for each procurement package along with the project specific report, complete technical specifications, schedules and drawings, price schedule required for open competitive bidding for the execution of the projects on a single responsibility basis of contract covering Design, supply and Install submit documents. The Consultant shall also provide the Quality Assurance Plan for implementation of these projects.

For each city/district and the procurement package, the Consultant shall prepare cost estimates based on quantities taken from the design and realistic unit prices derived from ongoing or recently completed similar works in the region by international and local contractors. Project costs shall also include a physical contingency sum based on perceived risk, and a price contingency sum, taking into account appropriate cost escalation factors and the period of time over which the projects will be procured, and constructed. The preparation of the cost estimates shall also take into account the

costs for all access roads and other road/bridge improvements as may be necessary to deliver equipment to site. The Consultant shall develop a confidential Unit Price Analysis for each work item and a Confidential Cost Estimate, for each work item, work category, section as may be defined and contract package as a whole. Unit prices shall be classified into direct costs (labour, materials and equipment), indirect costs (mobilization, on-site and general overheads, contractor's contingencies and profit). The Consultant shall also provide following information:

- Reference price level of estimates
- Currency and Exchange rates and their referenced period
- Level of Contingencies
- Level of inventories of materials, spares, etc
- Scaling factors used for scaling up/down cost of any major equipment/item
- Status of engineering and design on the basis of which the estimates have been framed
- Rates and quantity of the items on the basis of value analysis.
- Insurance, Transportation, Custom Duty and Taxes, etc

#### **4) Implementation Arrangement**

The consultant will work closely with the office of the Project or Client (ESCOM) and coordinate with ESCOM's specialized Departments, Local administration, relevant ministries & agencies as and when required. The consultant's team leader will be the principal contact and will be expected to be readily available at the Project office with a notice of seven days from the Project during the assignment period. The consultant will be responsible for all aspects of performance of services set forth in the TOR. The Client will be responsible for providing the existing available data and information and supporting arrangement for the necessary field investigations.

**Method Statements:** Prior to commencing any section of the work, the consultant shall submit method statement to the project in accordance with the requirement of the Consulting Services with the allocated input of days from both national and international experts and expected input from counterpart staff of ESCOM. When requested by the Client, the consultant shall provide additional method statements related to specific item of work.

**Progress Meetings:** The consultant shall hold periodic progress meetings with the Client at least once a month. Additional meetings shall be scheduled as required by the consultant's design. The intent of these meetings will be for the Client to provide input and to discuss options for addressing the Client's comments. The consultant shall fully cooperate with the Client in scheduling and attending such meetings as requested by the Client. These meetings shall be held at ESCOM office in Blantyre. The Client will be responsible to prepare meeting minutes during each of these meetings. Minutes will be distributed to participants for review and comment.

**Monthly Progress Reports:** The consultant shall furnish the Client with a written Monthly Progress Report that summarizes all aspects of the completed month and cumulative work progress. The objectives of the Monthly Progress Report are to:

- a) Provide a reliable and readily accessible summary record of the project activities with daily activities performed by each individual at the site and progress of work during the just completed month with verification of daily task in the site signed by the Project's representative.
- b) Provide a detailed description of all work actually completed to date and revision to the project schedule required, which shall reflect changes in the critical path since the date of the last revision.
- c) Identify issues and problems requiring action by the Client or consultant, including issues of conflicting priorities.
- d) Provide a forecast of the work to be accomplished in the next month.
- e) Provide information to help substantiate consultant's pay request.

**Submittal Protocol:** No later than thirty (30) days after the Contract Date, the consultant shall submit a submittal protocol for the Consulting Services. The submittal protocol shall identify the submittal packages to be prepared by the consultant including but not limited as specified in clause 10, including a detailed listing of the content, the expected dates of the submittals, number of copies, and distribution of the submittals by the consultant based on distribution information provided by the Client. The submittal protocol shall include the time allowed for the Client's review, which at a minimum shall be twenty (20) days. For large or complex submittals, the Client may require a submittal review period longer and the consultant shall coordinate with the Client inclusion of these review periods in the submittal protocol. The submittal protocol shall avoid the simultaneous submittal of a large number of submittals for the concurrent Client review.

**Consultant's Obligations:** The consultant shall provide submittals for review consistent with the submittal dates. The consultant acknowledges that the Client's review will often involve input from, or consultation with, a number of individuals. Therefore, should submittal dates to the Client be delayed, the consultant shall provide prompt notice to the Client of the delay. In no case shall this notice be given less than ten (10) calendar days prior to the scheduled submittal date for that submittal. The submittals shall identify any proposed change to the requirements, or the design concept, project delivery approach, or the project schedule provided in the consultant's proposal, accompanied by the rationale behind the proposed change. No changes shall be implemented without Client's acceptance. Such acceptance shall not, however, relieve the consultant of any of its obligations under the contract.

**Form of Submittals:** Each submittal shall be transmitted electronically and in hard copy, unless otherwise required by other sections of the TOR, with a cover letter to the Client (the Project office, ESCOM). Unless otherwise specified in the contract, the Consultant shall prepare up to eight (08) hard copies of each submittal for distribution. The Client is responsible for distribution of submittals to reviewers. Electronic submittals shall be in the original file format. The consultant is responsible for the accuracy and completeness of the information submitted.

The consultant shall make submittals far enough in advance of subsequent activities to allow time for reviews, consultations with other entities, for securing necessary acceptance, for possible revisions and re-submittals. The Client intends to process consultant's submittals as quickly as practical.

**Client's Review:** The Client will review submittals for consistency with the design concept presented in the consultant's proposal. The primary purpose of the Client's review is to satisfy itself that the submittals generally conform to the intent of the contract. The Client's review shall not relieve the consultant of the sole risk and responsibility for all defects, errors or omissions, or of sole responsibility for meeting all requirements of the contract. The consultant shall not proceed with implementation of any work affected by a submittal until review by the Client is complete and the submittal is returned with review comments as below:

**Approved:** Indicates submittal has been reviewed and appears to be in conformance with requirements of the contract. The consultant may proceed.

**Approved as Noted:** Indicates submittal appears to be in conformance with requirements of the contract, with the exception of noted corrections. The consultant shall incorporate the corrections noted but does not need to resubmit. The consultant may proceed.

**Returned for Correction:** Indicates submittal does not appear to be in conformance with the Contract. The consultant shall make necessary revisions and resubmit. The consultant shall not proceed.

**Rejected:** Indicates submittal is incomplete or insufficient information has been provided to conduct a review. The consultant shall provide the missing information. The consultant shall not proceed.

**Not Reviewed:** Indicates that the submittal is not called for by the contract and that no action was taken by the Client. The consultant may proceed.

The consultant is expected to commence the service by July 2022, and the duration of the service will be Fifteen (15) months.

## **5. Expertise and Person Month Requirements**

- 5.1. It is expected that about 48 person-months of international key experts and 60 person months of national non-key experts will be needed from a firm specializing in HV transmission line and substations including environmental social safeguard experts.

Consultant shall assemble a team of both key and non-key experts as per the table below. List of Experts (LOE) and estimates are notional and Consultants are free to propose their own LOE to match their methodology and staffing plans, noting any deviations from the notional LOE as well as the reasons behind them. Additional staff and staffing requirements may be proposed by the Consultant as necessary and based on the Consultant's proposed methodology and approach that will achieve the objectives of the assignment. Consultant shall provide and maintain all Key

Personnel. Any changes are subject to prior approvals by ESCOM in accordance with the terms of the contract.

The Consultant shall plan its activities and deliverables in such a way that most of the works will be done in Blantyre office so that ESCOM Engineers may attach with the Consultant's expert.

Table 1: Indicative Consultant Expertise and Person Months Requirements

<b>Person-month(pm)</b>					
<b>International Experts</b>					<b>National Experts, total pm</b>
<b>Position</b>	<b>Home</b>	<b>Field (KTM +Other Site)</b>		<b>Total pm</b>	
Team Leader/Transmission Line Expert	1	5	4	10	
Civil Engineer-Civil works & Structural (3 Nos for National)	2	2	3	7	12
Electrical Engineer- Substation Expert (3 Nos for National)	2	2	2	6	12
Survey Engineer (3 Nos for National)	1	2	3	6	12
Power System Analyst/Power System Planner	1	1.5	1.5	4	
Power System Control & Protection Engineer	1	1	1	3	
Telecommunication and SCADA Engineer	1	1	1	3	
Geotechnical Engineer (2 Nos for National)	1	0.5	1.5	3	6
Economist/Financial Analyst	1	1		2	
Environmental Safeguard Specialist (2 Nos for National)	0.5	0.5	1	2	9
Social Safeguards Specialist (2 Nos for National)	0.5	0.5	1	2	9
<b>Total</b>	<b>12</b>	<b>17</b>	<b>19</b>	<b>48</b>	<b>60</b>



## 6. Responsibilities of the International Experts

6.1. All international experts indicated in Table 1 are considered as key experts. The main responsibilities of each international experts are highlighted, but not limited to, as follows:

### a) Team Leader and Transmission Electrical Engineer

- (1) As the Team Leader, the expert is responsible for but not limited to:
  - (i) Leading and managing the entire team including both international and national experts and act as the team's point of contact with ESCOM.
  - (ii) Make necessary inputs and advice to the project team and to ESCOM on transmission line and transmission substation technical matters.
  - (iii) Develop a full understanding of project requirements through discussion with ESCOM.
  - (iv) Coordinate field surveys, necessary additional studies for the subproject to ensure that the line and substations meet ESCOM's overall requirements of the projects
  - (v) Coordinate to review all reports, drawings and plans prepared by or for ESCOM and related to the proposed subproject until bid preparation.
  - (vi) Contribute to capacity building of ESCOM counterpart staff.
  - (vii) Prepare regular reports in accordance with ADB's requirements.
  - (viii) Prepare or lead the team to prepare all the reports as listed in the Reporting Requirements in 10.
  - (ix) Handling contract administration matters related to the consultant contract.
  - (x) Support Project Management Division/ESCOM in administration of the preparation of all turn-key contracts for the Project.
  - (xi) Provide complete services or coordinate with appropriate expert or experts to fulfill the outlined tasks on clause 4 "Detailed Task" in this TOR
  - (xii) Prepare project designs, documentation and bidding documents; including and not limited to the technical specifications, performance specifications, schedules and drawings, price schedules; with assistance of other consultants of the Transmission lines & Substations for the subprojects on a turnkey basis and submit report with incorporation of the comments by ESCOM on the draft bidding documents and finalize the draft bidding documents until approved by ESCOM.
  - (xiii) Prepare Quality Assurance Plan for implementation during the construction.
  - (xiv) Monitoring project progress against plan, report on progress, and propose remedial measures as necessary.
  - (xv) Lead the consultant team to prepare detail cost estimate for subprojects
  - (xvi) Conduct other duties as reasonably requested by ESCOM-Project Management Directorate.
  
- (2) The Team Leader must also be an expert of transmission electrical engineering. As an transmission electrical engineer, he/she is responsible for:
  - (i) Provide inputs and advice to the project team and to ESCOM on transmission line technical matters and bid document preparation.
  - (ii) Define transmission line design technical parameters, conductor configurations, insulator and tower types, taking account of ESCOM's requirements and MALAWI-specific conditions including wind velocity, terrain type and altitude.
  - (iii) With support from other key and non-key experts' complete assignments as demanded by this consulting works.

**b. Electrical Engineer- Substation Expert**

- (i) Provide inputs and advice to the project team and to ESCOM on transmission line & substation related technical matters and bid document preparation.
- (ii) Define substation design technical parameters, taking account of ESCOM's requirements and Malawi-specific conditions including wind velocity, terrain type and altitude.
- (iii) Provide support to the Team Leader in completing transmission line & substation related assignments as demanded by this consulting works.

**c. Power System Analyst/Power System Planner**

- (i) Conduct Power System study of existing transmission line (including under construction transmission lines and transmission lines in the consideration)
- (ii) Conduct Power System study for the new/augmented transmission lines
- (iii) Provide support to the Team Leader in completing transmission line & substation related assignments as demanded by this consulting works.

**d. Line Survey Engineer**

- (i) Make necessary inputs and advice to the project team and to ESCOM on transmission line and substation survey and location matters.
- (ii) Contribute to the reports.
- (iii) Prepare and conduct on site route survey of the transmission lines and submit report with incorporation of suggestions from approving agencies.
- (iv) Work to support ESCOM for the preparation of project designs, documentation, bidding documents.
- (v) Provide support to the Team Leader in completing line survey related assignments as demanded by this consulting works.
- (vi) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.

**e. Civil Engineer- Civil & Structural (Transmission/Substation)**

- (i) Make necessary inputs and advice to the project team and to ESCOM on transmission line and transmission substation structural matters including foundation for towers and substation equipment.
- (ii) Prepare designs and layouts for the substations, transmission line tower foundations & substation equipment foundations and submit report with incorporation of suggestions from ESCOM taking into consideration seismic factors.
- (iii) Work to support and advise ESCOM for the preparation of project design criteria for towers and substation structures, documentation, bidding documents.
- (iv) Prepare detail cost estimate of transmission line.
- (v) Provide support to the Team Leader in completing Civil & Structural engineering related assignments as demanded by this consulting works.

**f. SCADA/Communications Engineer**

- (i) Assess ESCOM's existing SCADA and communications systems and prepare design concepts for interfacing with the transmission line and substations.
- (ii) Contribute in the preparation of project designs, documentation, bidding documents.
- (iii) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.
- (iv) Contribute in preparation of the conceptual designs and layouts for the substations, transmission line, tower foundations, substation equipment foundations, SCADA, communications, protection etc.
- (v) Conduct field visit and recommend SCADA/Communication system for the transmission line and substation communication matters of the subprojects with justification.
- (vi) Contribute to capacity building of ESCOM counterpart staff.
- (vii) Provide support to the Team Leader in completing SCADA/Communication related assignments as demanded by this consulting works.

**g. Control & Protection Engineer**

- (i) Make necessary inputs and advice to the project team and to ESCOM on transmission line and transmission substation protection system.
- (ii) Assess ESCOM's existing protection systems and prepare design concepts for protection of the transmission line and substations.
- (iii) Contribute to capacity building of ESCOM counterpart staff.
- (iv) Conduct field visit and recommend protection system for the subprojects with justification.
- (v) Study the system, determine the protection requirement for T/L and substation and perform necessary calculation and suggest the Protection settings.
- (vi) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.
- (vii) Provide support to the Team Leader in completing Protection related assignments as demanded by this consulting works.

**h. Environmental Safeguard Specialist**

- (i) The Social Specialist shall be responsible for assessment of environmental and social impacts and preparation of IEE reports.
- (ii) Conduct a detailed qualitative and quantitative analysis of the anticipated changes to the baseline to determine the direct, indirect, induced and cumulative impacts of the project in construction, phase. These impacts may include, but not limited to, loss of habitat and ecosystems, loss of flora and fauna, impacts on wildlife, food supply chain and migration patterns of wild life, water quality, emission of greenhouse gases, erosion and sedimentation, loss of physical and cultural resources, impacts associated with construction etc.
- (i) Conduct and Prepare draft EMP for the individual subprojects.
- (ii) Perform other functions as may be assigned or delegated by Team Leader from time to time.
- (iii) Provide support to the Team Leader in completing environmental safeguard related assignments as demanded by this consulting works.

#### **i. Social Safeguard Specialist**

- (i) The Social Specialist shall be responsible for assessment of social impacts.
- (ii) Make necessary inputs and advice to the project team and to ESCOM on social safeguard issues as required by the national laws and regulations
- (iii) Prepare detail reports of land and plots to be acquired / purchased along the ROW of Transmission Lines and for Substation.
- (iv) Prepare land acquisition and resettlement impact assessment based on selected route alignment and substation details.
- (v) Prepare the draft entitlement matrix for each subproject listing all likely effects, such as permanent and or temporary land acquisition, and a study to determine the replacement costs of all categories of losses based on the asset valuation process, with particular attention to vulnerable groups including indigenous peoples, women, children and the poor and socially excluded.
- (vi) Prepare and/or update detail cost estimate of land acquisition, RoW acquisition and resettlement for each subproject.
- (vii) Provide guidance to the national social safeguard specialist for social safeguard in data collection and census surveys of affected persons.
- (viii) Perform other functions as assigned or delegated by the Team Leader from time to time during the time of assignment.

#### **i. Geotechnical Engineer**

- (i) Perform field sampling and measurements to determine the site soil conditions in conjunction with other team members.
- (ii) Make necessary inputs and advice to the project teams and to ESCOM on transmission line and transmission substation geotechnical matters.
- (iii) Contribute to the preparation of project designs, documentation, bidding documents.
- (iv) Perform other functions as may be assigned or delegated by Team Leader from time to time during the time of assignment.
- (v) Provide support to the Team Leader in completing geotechnical related assignments as demanded by this consulting works.

#### **k. Economist/Financial Analyst**

- (i) Perform Economic and Financial analysis of the Project/subprojects.
- (ii) Make necessary inputs and advice to the project teams and to ESCOM on transmission line and transmission substation financial related matters.
- (iii) Provide support to the Team Leader in completing finance related assignments as demanded by this consulting works.

### **6. Responsibilities of the National Experts**

- 6.1. Although national consultants are classified as non-key in the proposal evaluation, they play important role in the consultant team with local knowledge of dealing with social, technical and geographical issues arising from the Project. Each national expert will perform the same or similar duties as his/her counterpart in the international team in his/her respective field.

## 7. Counterpart Support and Inputs Provided by ESCOM

- 7.1. **ESCOM Project Team:** Project office, Project Management Directorate- ESCOM shall work in close collaboration with the Consultant's team and be fully involved in all aspects of the consulting services. Both ESCOM and Consultant's teams shall work together as one single team in all matters related to the Project.
- 7.2. **Project Preparation:** ESCOM engineers and technicians will support in preparation activities at different site locations of the subprojects and the Consultant shall report to and work in tandem with the Project Office, ESCOM.
- 7.3. **Administrative support for consultant Team:** If required by local regulations, ESCOM will provide consultant with necessary support letters for obtaining visas and permits for its experts. The cost and timing of obtaining the above is entirely the responsibility of the consultant.
- 7.4. **Office Space, Office Equipment, Transportation and Accommodation:** The Consultant shall make his own arrangements for office space, necessary furniture and office equipment (computers, telephone etc.); shall make his own arrangements for transportation in Blantyre and local transportation and accommodation for its personnel in the project sites outside of Blantyre. The consultant shall arrange itself any other equipment required during execution of works.

## 8. Qualification/Experience of Experts

Role	Qualification
<b>A. International Key Experts</b>	
Team Leader/TL expert (or	He/She shall be an independent professional with strong
equivalent Title)	organizational skills, with a preferably Master degree in electrical engineering/power system engineering or equivalent. He/she shall have extensive knowledge of international best practices in power system planning and infrastructure design, contract procedures and project follow-up. He/she shall also have a proven track record of successfully managing and coordinating <b>as team leader</b> a diverse group of professionals in accomplishing projects of similar nature and complexity to this assignment. Preferably a minimum of <b>15 years</b> of working experience in planning & implementation of electricity transmission projects is required. The Team Leader shall have preferably in the <b>last ten years</b> , specific experience of managing consultancy teams working on project planning, feasibility study and design of at least one transmission line projects of 132 kV or above in countries other than Expert's home country. Additional experience, as Transmission line expert, in Underground Transmission Line and Overhead Transmission line using monopoles for the cities will be preferred.

Civil Engineer-Civil works & Structural	He/she shall have preferably a preferably Master's Degree in civil Engineering/Structural Engineering with preferably 10 years' experience in overhead and underground transmission line designs of 132 kV or above voltage class and civil works associated with HV transmission projects, related to the feasibility study and detail design of civil structures, Gantry structure tower/and equipments foundations of 132 kV or above transmission lines, and substations and buildings. Additional experiences in civil & structural design of multi-story buildings for compact substation and detail design of monopoles for overhead lines will be preferred.
Electrical Engineer-Substation Expert	He/She shall have preferably a preferably Master Degree in electrical engineering or relevant fields, coupled with preferably 15 years of relevant experience. Experience in Overhead and Underground transmission network including substations of 132 kV or above design and operations are required. He/She shall have specific experience of working on preferably one transmission line including preferably one substation planning, feasibility study and design projects of similar nature to the proposed projects. Extensive knowledge of international best practices in electric transmission system planning, line routing processes, maintenance, and transmission system design is critical. Additional experience in design of compact substation for the cities will be preferred.
Survey Engineer	He/She shall have preferably Bachelor's Degree in Survey/Civil Engineering or other relevant discipline and preferably over 15 years of consulting experience, with
	previous experience in detail survey of 132 kV or above transmission lines in countries other than the expert's home country. Experience shall include route definition, detail survey, profiling, contouring and tower spotting. The expert shall have an understanding of line clearances and safety considerations. He/she shall also have an extensive knowledge on handling and operation of PLS-CADD, AutoCAD and other similar software.
Power System Analyst/Power System Planner	He/She must have preferably 10 years' experience in power system/transmission system planning, electrical system modeling and analysis, and be familiar with system analysis software such as PSS/E. He/she should be well-versed in load flow, stability and short-circuit analysis as well as international best practices in power system planning

Control and Protection Engineer	He/She shall have preferably a Bachelor Degree in Electrical Engineering coupled with preferably 10 years of relevant experience in designing/planning of Control and Protection system for interconnected/integrated power grid system. He/She shall have specific experience of working on preferably one substation projects of 132 kV or above
Telecommunication & SCADA Expert	He/She shall have preferably a Bachelor Degree (Preferably Master Degree) in Electrical/Electronics/ communication Engineering with preferably 10 years' experience in telecommunication & SCADA systems associated with transmission system projects, including experience with fiber optic and OPGW based tele-protection systems and equipment.
Geotechnical Engineer	He/She shall have preferably Master's Degree in Geotechnical/Civil Engineering and preferably 10 years of experience, with previous experience in countries other than the expert's home country. The experience shall be in geotechnical investigation, test and recommendation of foundations of 132 kV or above voltage level transmission lines and substation.
Economist/Financial Analyst	He/She shall have preferably Master's Degree in Economics, Business Administration, Finance or related studies with preferably 10 years of consulting experience. The experience shall be in Financial/Economic analysis of infrastructure projects.
Environmental Safeguard Specialist	He/She shall have preferably Master's Degree in Environmental Science/ Environment Management/ Environmental Engineering or closely related discipline with preferably more than ten (10) years of consulting experience in the related field. The experts shall have experience in conducting environmental impact analysis(EIA)/initial
	environmental examinations (IEE) of transmission line projects as per international standard and practice as well as latest other donor agencies guidelines with regard to environmental protection and resettlement. The specialist should be conversant with national laws relating to Initial Environment Examination (IEE)/Environmental Impact Assessment (EIA) and latest Government Safeguard Policy

Social Safeguard Specialist	He/She shall have preferably Master's Degree in Sociology/Social Science/Anthropological Science with preferably more than ten (10) years of professional experience in the related field. The Specialist shall have experience in preparation of Resettlement Plan and Indigenous Peoples Plan etc., transmission line projects as per projects in accordance with the international practices as well as latest donor agencies' guidelines, preferably other Guidelines with regard to environmental protection and resettlement. The Specialist should be conversant with national laws relating to land acquisition and resettlement and latest Safeguard policy.
<b>B. National Experts- Non Key</b>	
Electrical Engineers-TL & SS ( 3 Nos)	He/she Shall have preferably Bachelor's Degree in Electrical Engineering/High Voltage Engineering or other relevant discipline and 5 years of experience in transmission line and substation project planning, feasibility study, design, specification preparation, construction/operation of 132 kV or above voltage class.
Civil Engineers- TL&SS ( 3 Nos)	He/she shall have preferably Bachelor's Degree in Structure/Civil Engineering or other relevant discipline with preferably over 5 years of experience in project preparation of transmission line and substation of 132 kV and above voltage level. He/she shall also have knowledge of the design of foundations for transmission line towers and substation structures for 132 kV and above voltage level. The expert shall have knowledge on AutoCAD or similar software.
Survey Engineer/Surveyor (3 Nos)	He/she shall have preferably Bachelor's Degree in Survey/Civil Engineering or other relevant discipline and preferably 5 years of experience in detail survey of 132 kV or above transmission lines. Experience shall include route definition, detail survey profiling and contouring in mountainous/hilly terrain. The expert shall have an understanding of line clearances and safety considerations and knowledge on AutoCAD or similar software.
Geotechnical Engineer	He/She shall have preferably Master's Degree in Geotechnical/Civil Engineering and preferably 10 years of experience. He/She shall have a knowledge and understanding of geography of Malawi. A thorough understanding of down wasting and
	landslide mechanisms is also essential. Additional experience shall be in geotechnical investigation, testing and recommendation of tower foundations of 132 kV or above voltage level transmission lines and substation structures



Environmental Safeguard Experts (2 Nos.)	He/She shall have preferably Master's Degree in Environmental Science/ Environment Management/ Environmental Engineering or closely related discipline with preferably more than ten (10) years of professional experience in the related field. The experts' shall have experience in the assessment of environmental impacts and preparation of IEE reports of infrastructure projects in accordance with the international practices as well as latest donor agencies' guidelines with regard to environmental protection and resettlement. The Specialist should be conversant with national laws relating to land acquisition and resettlement.
Social Safeguard Specialist (2 Nos.)	He/She shall have preferably Master's Degree in Sociology/Social Science/Anthropological Science with preferably more than ten (10) years of professional experience in the related field. The Specialist shall have experience in preparation of Resettlement Plan and Indigenous Peoples Plan etc., in the infrastructure projects as per projects in accordance with the international practices as well as latest donor agencies' guidelines, preferably ADB Guidelines with regard to environmental protection and resettlement. The Specialist should be conversant with national laws relating to land acquisition and resettlement Safeguard policy

## 9. Reporting Requirements

Following the signing of the Contract and issuance of the contract commencement, the consultancy service shall commence with a formal kick-off meeting with ESCOM. The Consultant shall be represented by at least the Team Leader/Project Manager and key technical personnel. The purpose of the kick-off meeting is to address any questions about the Contract or scope of work and to clarify expectations regarding the services.

The services under this contract are expected to be conducted for a period of approximately Fifteen (15) calendar months. The Consultant may propose adjustments to the timing and schedule of deliverables outlined below, provided that any alternative schedule will meet the completion period of ESCOM's requirements.

The Consultant shall be expected to be available during the period of performance and shall be responsible for management of the services. This includes supervision and management of the consultancy, liaison with ESCOM and other parties, office management, and ensuring quality control of services. As part of project management, a number of meetings between ESCOM and the Consultant may be scheduled at any point in time. The Consultant shall produce minutes of all such proceedings. The Consultant shall prepare the various reports and maintain records documenting decisions made at meetings, progress on project preparation, financial records and changes to the contract plans. The reporting shall, in general, comprise including but not limited to the following:

### Task 1: Inception of the Assignment

- i. Demand forecast report for each city for the year 2030, 2040 and 2050.

- ii. Desktop Identification and Evaluation of Areas For Grid Extension And Areas For Reinforcement and Up-gradation of Existing System
- iii. Consolidated Inception report

### **Task 2: Project Planning & Preparation**

- i. Report on review of all reports, drawings and transmission plans prepared for ESCOM or for the Cities as applicable
- ii. Report on Power Evacuation study (power evacuation through the existing, under construction and proposed transmission lines in the cities)
- iii. Desk study survey report
- iv. Consolidated Project Planning & Preparation Report

### **Task 3: Feasibility Study**

- i. Report on base design including base drawings, Single line diagram and preliminary cost estimates of transmission line and substations
- ii. Topographic Survey Report of Substations
- iii. Technical feasibility assessment report
- iv. Financial and Economic Analysis Report
- v. Environmental and Social Assessment Report, IEE Report
- vi. Consolidated Feasibility Study Report for the year 2030, 2040 and 2050.

### **Task 4: Design of Transmission Lines and Substations**

- i. Report on Geotechnical investigation and geological stability slope stability studies for tower locations as specified in Scope of Services
- ii. Report on definition of transmission line and substation design technical parameters, conductor configurations, insulator and special tower types, taking account of ESCOM's requirements and Malawi-specific conditions including wind velocity, terrain type and altitude, single line diagram
- iii. Design report on design of AIS or/and GIS substations (multi-tier substations) including typical design of gantry structure & their foundations, equipment structure and their foundation, equipment foundation, earthing design, SCADA, communication design, protection design, control building & cable trenches etc and all associated single line and schematic drawings with incorporation of suggestions from approving agencies.
- iv. Detail design of transmission line with Monopole arrangement for any one city
- v. Detail design of underground transmission line project for any one city
- vi. Detail design of multi-tier compact substation for any one city

### **Task 5: Procurement packages and Cost Estimate**

- i. Report on recommendation on various procurement packages as required.
- ii. Component wise cost estimate of the transmission lines and substations

All documents and reports would be made available on hard copy as well as electronic format. Electronic submission/reports shall be in the original file format. Consultant must submit Design Drawings/Construction Drawings in editable format. All reports will be in English language. The above

reporting requirements or deliverables are minimum requirement and NEA may ask consultant to submit any other intermediate reports as deemed necessary and as transpired during the period of contract in connection with the service rendered as per the Scope of Services. However, should the Consultant find better idea on above reporting requirement (deliverables), the same may be suggested in the technical proposal. However, the acceptance of which shall be ESCOM's prerogative.

The Consultant is also required to make presentation in front of ESCOM management upon the completion of each category of task. ESCOM shall intimate the consultant about the date, time and venue of such presentations in at least a week prior to the presentation date.

## 10. Deliverables and Payment Schedule

This consulting assignment will be based on Lump Sum contract and consulting Firm will be paid upon completion of the Deliverables (Milestones). The following table summarizes the deliverables and associated payments, which are described more fully below, and their due dates:

**Advance Payment:** 10% of the contract amount will be paid as advance payment against unconditional Bank Guarantee. Advance will be deducted proportionately from each payment until same is fully repaid.

**Retention Money:** 5% of the contract amount will be retained on each payment for the validation of the whole Designs and Demarcation works produced by the Consultants where the Consultant may require to provide further justifications and clarifications to the Concerned Employer or Contractor during the Construction phase of the above project. The amount shall be retained for maximum 2 (two) years from the Completion of the consulting contract under the scope. However, the retained 5% amount may be released against the unconditional Bank Guarantee.

The following table summarizes the deliverables and associated payments, which are described more fully below, and their due dates:

S.No	Milestones (submission and acceptance of reports under the various tasks of Scope of Services)	Due date	Payment (% of Contract Price)	Cumulative (% of Contract price)
1	Reports under Task 1(Inception Report)	Within 60 days of Contract Commencement	15%	15%
2	Reports under Task 2 (Project Planning & Preparation Report)	Within 120 days of Contract Commencement	15%	30%
3	**Reports under Task 3 (Feasibility Study Report)	Within 330 days of Contract Commencement	40%	70%

4	Reports under Task 4 (Detail Design Report)	Within 420 days of Contract Commencement	20%	90%
5	Reports under Task 5 (Procurement packages and Cost Estimate)	Within 450 days of Contract Commencement	10%	100%

(\*\*): In case of IEE, TOR approval and draft IEE report submission will be required)