Ethiopian Electric Power

Terms of Reference

for

Consultancy Services for Design & Preparation of Detailed Technical & Functional Specificatitions for EEP's Measurement & Instrumentation Testing & Calibration Facility

February 2024

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1. Introduction

1.1 Contextualization

The electricity sector in Ethiopia is growing rapidly due to the government's policy of electrifying the entire population by 2030, 96% of which will be connected to the national grid (and 4% through off-grid solutions). The response to this objective is a significant investment in the new generation, transmission, and distribution infrastructure. On the generation side, Ethiopia has, between 2008 and 2023, significantly increased its generation capacity from 755 MW to 5256 MW. In its ten-year development plan, Ethiopia aims to considerably increase its production capacity (to reach 17,056 MW by 2030), while diversifying its energy mix by increasing wind, solar and geothermal capacities, in order to reduce dependence on hydroelectric energy.

This growth policy is mainly implemented by Ethiopian Electric Power (EEP), the operator in charge of producing and transporting electricity in the country. In addition to investment efforts in infrastructure EEP has embarked on an initiative to fulfill ISO standard requirements. This also required standard facilities to standardize the processes of meter & instrumentation testing and calibration to ensure the efficient and sustainable operation of these infrastructures.

1.2 Background: Existing testing Operation

EEP currently lacks state-of-the-art facilities for testing meters and instruments, hindering its testing capabilities. Other utilities are used to support the measurement, instrumentation testing, and calibration process. Owing to this, EEP encountered limitations in conducting testing and periodic calibration of instruments used for testing and measuring devices.

2. Objectives of the Implementation of System Instrumentation Improvement Project (SIIP)

2.1 General Objectives of the Project

The project's rationale is to support the energy management & auditing operations to ensure the measurement & instrumentation testing and calibration operation is free of errors and support the smooth operation of the main electrical grids. The overall aim of the project is to improve the efficiency of the grid operation and revenue management system of the company by:

(i) Establish State-of-the-Art Testing Facility: Establish a modern and purpose-built facility for system instrumentation testing, equipped with the necessary infrastructure to support advanced testing procedures.
(ii) Enhance Research and Development Capabilities: Provide a conducive environment for research and development by creating a cutting-edge instrumentation testing facility to facilitate innovation and technology advancements.
(iii) Ensure Compliance with Industry Standards: Establish the facility in accordance with industry standards and regulations, ensuring that it meets the necessary safety and performance criteria.
(iv) Optimize Operational Workflow: Develop a facility layout that promotes efficient workflow, ensuring seamless operations from testing to data analysis and reporting.
(v) Facilitate Collaboration and Training: Create spaces within the facility to encourage collaboration among teams and provide areas for training sessions, fostering knowledge exchange and skill development

(vi) Strengthening Mobile workforce: Strengthen EEP's energy management & audit function, enabling it to perform effectively the testing & calibration operation on the field operations;

(vii) Capacity Building: Raising the knowledge & skills level of its employee in the area of metering, instrumentation testing & calibration operation activities;

(viii) Generate Revenue: Gradually open up the metering & instrumentation facility to generate additional revenue to the company attracting other utility operators in the country or region.

2.2 Specific Objectives of the Project

(i) Identify Specialized Testing Equipment and prepare BOQ to procure and install state-of-the-art testing and calibration equipment, including instrumentation devices and tools, to support a wide range of testing scenarios and research activities.

(ii) Identify all necessary equipments for meter and instrumentation testing & calibration operation activities.

(iii) Prepare detailed bid documents outlining the specifications, requirements, and standards for the supply and installation of system instrumentation testing facilities, ensuring clarity for potential bidders.

(iv) Identify and Prepare training plan for Knowledge Transfer and User Training

(v) Prepare a business model and market strategy to generate additional revenue to support its own operations.

(vi) Establish a robust documentation and reporting system within the facility, to organize collect, analyze, and disseminate the testing data.

3. Project Financing

The World Bank will support the project financing through IDA credit towards the project costs. The Government of Ethiopia will finance the administrative cost of the Project. EEP is the implementing agency of the project.

4. Scope of the Consulting Service

The overall scope of the consultancy services covers designing and identifying all lab requirements, specifications, training, prepare the bid document, and develop a business model and market strategy to generate its own revenue. The consultancy services to be provided by the Consultant will include the following tasks:

5.1. Detailed design and technical Specification for testing and Calibration Equipment

First the consultant shall identify the necessary measurement & instrumentation testing and calibration equipment installed in the facility and mobile testing & calibration equipment used for site works, furniture & appliances and defines the detailed technical & functional specification of each measurement & instrumentation testing and Calibration equipment. The following List of equipment - commonly tested in a utility's in-house laboratory:

a) Meters and Instruments:

- Single phase and three phase energy meters (electromechanical, electronic, smart)
- Power quality & Harmonic analyzers

- Volt meters
- Current meter
- Flow meters
- Pressure
- Temperature

b) Power Transformers:
- Distribution transformers
- Power transformers
- Transformer bushings
- Transformer oil

c) Voltage and Current Transformers:
- Current transformers
- Voltage transformers
- Instrument transformers

d) Gas Analysis Equipment:
- Gas chromatographs for analyzing transformer oil
- Gas analyzers for insulating gases in switchgear

e) High-Voltage Testing Equipment:
- High-voltage testers
- Impulse voltage generators
- Partial discharge testers

f) Protection Relay and Protection Devices
- Overcurrent and earth fualt relays
- Differential relays
- Distance relays
- Autoreclosure relays
- Buckholze relay
- Disturbance Recorders
- Fault locator
- Ground resistance testers
- Fire Protection systems
- Personal protective equipment (PPE) testing

g) Switchgear and Substation Equipment:

- High-voltage switchgear
- Substation automation systems
- Disconnect switches
- Surge arrestors
- Air circuit breakers
- Oil circuit breakers
- Gas-insulated circuit breakers
- Vacuum circuit breakers.

h) .Power Cables and Accessaries
- Power cables (medium and high voltages)
- HVAC withstand
- Partial discharge (online and offline)
- Sequence/line impedance

- Very Low Frequency (VLF) Withstand
- Dielectric loss
- Time Domain Reflectometry (TDR)
- Optical Time Domain Reflectometer (OTDR)
- Jacket integrity test
- Conductor resistivity
- Insulation resistance
- Phase identification

i) High voltage transmission lines inspection instruments
- Insulation resistance testers
- Thermal imaging cameras
- High voltage detectors
- Portable oscilloscopes
- Partial discharge testers

j) Battery tests
- Battery impedance testers
- Battery capacity testers

The consultant will prepare the bid documents to procure measurement & instrumentation testintesting & calibration equipment. The consultant will prepare the full bid documents for the procurement process of this equipment, in particular:

a) Detailed specifications and description of all equipment, bill of quantity,
b) Bid document for the procurement of these equipment including the detailed specifications, the time schedule of delivery, the completion schedule,
c) The furniture and equipment for all technical workshops will be defined by the consultant.

The Consultant will be responsible for the exact definition and numbering of the furniture and laboratory equipment instruments as electrical and communicaitons appliances. The Consultant will define the full list of testing equipment, instruments; calibration device measuring instruments furniture's, electrical and other applianceswithout limitation. The consultant will submit all procurement documents to client & Bank for validation.

5.2. Develop a Business Model

To ensure part of the financial sustainability as well as position it as a flagship measurement & instrumentation testing and calibration center in the power sector, a business model and market strategy will be developed by the consultant to support EEP in marketing of testing and the calibration services to generate additional revenues. The consultant will define service that can be offered, list the potential clients and produce a business plan which will define income, costs, activities, and budget to deliver the service, and related logistics. The consultant shall prepare a detailed proposal to identify and create new channels for partnership developments, customer acquisition, regionally and nationally. The proposal includes networking and partnership development plan, communication plan and associated tools (website, catalogue, newsletter, flyer, etc.) to implement a communication campaign about the service offer of the measurement & instrumentation testing & calibration facility.

The consultant will also propose the measurement & instrumentation testing & calibration facility organizational structure, governance and staffing size & plan and lead to the creation of

the EEP's measurement & instrumentation testing and calibration department within EEP organizational structure. The consultant will also support the definition of the facility technical and management staff competency requirements (skills, knowledge & attitudes), the job descriptions of all staffs working in the facility and the staffing, recruitment , succession and the implementation plan including training & development plan.

5.3. Need Assessment

a) Assess current condition: Inventory report with detailed specifications, condition assessments, and historical usage patterns of existing measurement and instrumentation testing & calibration equipments.
b) Identification of Gaps: Report outlining identified gaps, prioritizing critical needs based on user feedback and industry advancements/benchmarks of measurement and instrumentation testing & calibration facilities.
c) End-User Consultation:
   - Conduct interviews, surveys, or workshops with end-users to gather specific requirements and preferences.
   - User needs analysis highlighting critical functionalities and desired improvements.

5.4. Technology Review & Market Analysis and Development of Specifications

a) Market Research:
   - Conduct market research and prepare a comprehensive market analysis document summarizing the latest trends, innovations, and emerging technologies of measurement and instrumentation testing & calibration facilities.
   - Comparative analysis of different manufacturers and models measurement and instrumentation testing & calibration equipments.
b) Compatibility Assessment & Marix:
   - Evaluating the compatibility of new technologies of measurement and instrumentation testing & calibration equipments with existing systems.
   - Matrix detailing the compatibility of measurment and instruments testing & calibration facilities with existing infrastructure.
   - Recommendations for technologies that seamlessly integrate into the current infrastructure.
   - Guidelines for future expansion and system integration.
c) Detailed Specifications Document:
   - Prepare a detailed technical specifications document for each type of measurment and instruments testing & calibration, including accuracy requirements, measurement ranges, and compliance standards.

5.5. Quantitative Analysis, Bill of Quantity (BOQ), Cost Estimates and Vendor Identification and Qualification

a) Bill of Quantity Document:
   - Detailed list of measurment and instruments testing & calibration equipments, including quantities, units, and specifications.
   - Itemized breakdown for easy reference during procurement.

b) Cost Estimates:
   - Detailed cost estimates for each measurment and instrument testing & calibration equipments, considering purchase costs, installation, and potential ongoing expenses.
   - Budget breakdown for the entire procurement process

c) Vendor Shortlisting Report:
   - Shortlist of potential vendors based on their reputation, experience, and capabilities.
   - Criteria for vendor shortlisting, such as industry certifications and previous project success.

d) Qualification Criteria:
   - Document outlining specific criteria for vendor selection.
   - Scoring system for evaluating vendor qualifications and capabilities.

5.6. Procurement Plan and Bid Document Preparation

a) Procurement Plan:

   - Detailed plan outlining the procurement process from vendor selection to final delivery.
   - Schedule for each procurement phase, including milestones and dependencies.

b) Vendor Management Protocol:

   - Protocols for ongoing communication and collaboration with vendors.
   - Procedures for addressing issues, disputes, and ensuring timely delivery.

c) Project Schedule

   - Gantt chart illustrating the timeline for the entire process for procurement and establishment of the facility.
   - Milestones for vendor selection, order placement, delivery, and commissioning.

d) Bid Document:

   - Bid document with project overview, detaile technical specifications, and submission guidelines.
   - Instructions for bidders, including key deadlines and evaluation criteria.
   - Clear instructions on formatting and content requirements for bid submissions.
   - Criteria for evaluating bids, including technical capabilities, compliance with specifications, and cost considerations.
   - Scoring system for each criterion to facilitate objective evaluation.

5.7. Training and Knowledge Transfer

a) Training Plan:

   - Development of a comprehensive training methodology and training plan for end-users.

- Curriculum detailing how to operate, maintain, and troubleshoot each measurement and instrument testing & calibration equipments.

b) Training Materials:
   - Preparation of training manuals, videos, and presentations.

5. Deliverable & Project Implementation Schedule

No	Deliverable	Description	Schedule
1	Inception report	Inception reports shall be submitted in three (3) copies. The inception report shall be submitted within two (2) weeks of commencement of work.	within two weeks after contract signing
2	Detailed technical & Functional Specificaiton of Measurement & Instrumentation testing & calibration facility equipment	Detailed technical & functional Specificaton of Measurement & Instrumentation testing & calibration equipment for office and field operations.	within twenty weeks after contract signing
3	Bid Document (contract 3)	Contract 3: Bid document for Supply, installation, test and commisioning of metering & instrumentation equipments for EEP's metering & instrumentation testing & calibration facility	within twenty-two weeks after contract signing
4	Business Model	A detailed Business model (including marketing strategy, service & material costs, input, processes, output, target customers, channels, value offerings, etc.,) proposal for EEP's metering & instrumentation testing facility including organizatonal & governance struture, competency requirements, staffing plan, grading plan, carreer path, training plan, succession plan for smooth operations of the facility, etc.,	within sixteen weeks after contract signing
5	Progress Report	A progress report shall be submitted every month in two (2) copies, one (1) month from the submission of the inception report. More generally, each progress report will include information on work in progress and completed, staff strength, time spent by each staff member on each task, estimated percent of work completed by task. The percentage of completion of each task shall be shown computed on weighted average. The overall percentage of completion for the work shall also be shown. The list of any problems that are causing or may cause delays, including proposed measures to correct the problems shall also be reported. Reports shall also include a financial summary indicating amounts invoiced	each months

6. Contract Packages

This contract packages will have two separate contracts:

6.1. Contract 1: Consultance Service for Design & Preparing a deteaild Technical & Functional Specificatitions for EEP's measurement & instrumentation testing & calibration facility.

6.2. Contract 2: Design and build of Laboratory building for EEP's metering & instrumentation testing facility.

6.3. Contract 3: Supply, installation, test and commisioning of metering & instrumentation equipments for EEP's metering & instrumentation testing facility

6.4. In this consutancy service, only contract 1 will be execuctued.

7. Man – Month Allocation

7.1. The Consultant will indicate in its proposal sufficient man-months for proper execution of the project.

7.2. The consultant should clearly indicate the man-months to be spent on each activity.

7.3. Considering the technical and financial evaluation, contract shall be awarded to the consultant whose entire result reflects the evaluation criteria.

7.4. The Consultant should assume that all experts should be mobilizing to the site. Data collection & any other related investigations shall progress in parallel in all sites and coordinated and monitored as envisaged below.

7.5. The Consultant shall provide a detailed schedule with breakdown for the various activities called for in the TORs, including the project office and field activities.

7.6. The consultant should clearly indicate the man-months to be spent on field activities, and home Office.

7.7. The consultant will be evaluated with the total man-month proposed for both field and home office activities The total man-months proposed for field activities is ten point 3(10.3).

7.8. The minimum proposed man-month by the Consultant shall not be less than the estimated man-month by the clients as follows, for each key personnel and activity.

No.	Descriptions of Key Expert staffs	Number of expert	Estimated Man-Month	
			In Ethiopia	Home office
1	Resident Project Manager	1	5	0
2	Instrumentation & measurement expert	1	2	0
3	Protection Relay Expert	1	1,5	0

No.	Descriptions of Key Expert staffs	Number of expert	Estimated Man-Month	
4	Transformer & Switchgear Expert	1	1.5	0
Total Man-Month			10.3	0

8. Qualification of Key Expert Staffs

The Consultant shall justify his capability to mobilize enough skilled staff for carrying out the project activities within the allocated period of time and including all necessary engineering specialists. For this purpose, the consultant will provide the signed Resumes of the experts who will work on the project. Resumes will be evaluated by the Client and could be subject to scrutiny.

8.1. Resident Project Manager

- The resident project Manager of the Consulting firm must have minimum of BSc in the field of Instrumentation & Control Engineering, Electrical Engineering or related field.
- Must have fifteen (15) years of professional experience.
- Atleast three (3) Instrumentation & Testing implementation project experience for the last 10 years.
- Fluency in English.

8.2. Instrumentation & measurement expert

- The instrumentation & measurement expert must have a minimum of BSc degree in instrumentation & measurement or related field
- Must have fifteen (15) years of professional experience in the field and out of which five (5) years' experience related to power sector.
- The instrumentation & measurement expert must have an experience at least on two (2) projects.
- Fluency in English.

8.3. Protection Relay Expert

- The Protection expert must have a minimum of BSc degree in Protection system or related field
- Must have fifteen (15) years of professional experience in the field and out of which five (5) years' experience related to power sector.
- The Protection expert must have an experience at least on two (2) projects.
- Fluency in English.

8.4. Transformer & Switchgear Expert

- The Transformer & Switchgear expert must have a minimum of BSc degree in electrical engineering/power transformer/switchgear equipment/Protection system or related field.
- Must have fifteen (15) years of professional experience in the field and out of which five (5) years' experience related to power sector.
- The Transfomer & Switchgear expert must have an experience at least on two (2) projects.
- Fluency in English.

9. Time schedule

9.1. The measurement & Instrumentation testing and calibration implementation Facility consultancy service should be completed within five (5) calendar months after the service contract is signed.

10. Offices and office facilities

10.1. The client will not provide offices and facilities to the consultant.

10.2. The Consultant shall provide to the client two (2) heavy duty color printers and two (2) LCD projectors. These office facilities will remain EEP's property.

10.3. The Consultant shall provide full/detailed specifications and supporting documents (catalogues, descriptions and technical documentation) of each item with model/type and product # for the evaluation in the technical offer. If the specified type/model of items will not be available at the time of supply the consultant will supply the higher model of the concerned item in its range.

10.4. Office facilities to be supplied to the client are:-

a) Heavy Duty Color Printer

Sr. No.	**Features**	**Desired Technical Features**
1	Print and Copy Speed	25 Pages per Minute Black and White (A4); 25 Pages per Minute Colour (A4); 15 Pages per Minute Black and White (A3) and 15 Pages per Minute Colour (A3)
2	Warm-Up Time	Approximately 30 seconds from low power mode
3	Paper Size and Weight	Cassettes: A5R-A3, 64-256 gsm; Bypass: A6R-320 x 460 mm, 64-280 gsm, banner paper 305 x 1,200 mm, 90-163 gsm.
4	Paper Capacity	2 x 550 sheets (Cassettes);100 sheets (Bypass) and Maximum: 3,700 sheets
5	Automatic Duplex	A5R-A3+, 64-256 gsm
6	Memory	HDD 160 GB, 1.5 GB RAM
7	Interface	10/100/1000 BaseT (incl. IPv6), High Speed USB 2.0, WLAN* (IEEE802.11b/g), Bluetooth*
8	Dimensions	Approximately 699 x 808 x 759 mm (W x D x H)
Print		
9	Resolution	Maximum: 600 x 600 dpi, 8 bit per colour channel

Sr. No.	Features	Desired Technical Features
10	Page Description Languages	XPS, PCL6 and PostScript 3 compatible
11	Supported Systems	Windows , Mac OS X, Linux/Unix
12	Colour Modes	Auto-Colour (ACS), Colour, Twin Colour, Black and White
13	Colour Settings	Brightness, Saturation, Contrast, Colour Balance, ICC profiles management
14	Print Functions	Universal Driver, Driver templates, Driver plug-ins, Hold print, Print from USB, Tandem Printing
Scan		
15	Resolution	Maximum: 600 x 600 dpi, 8 bit per channel
16	Scan Speed	Maximum: 57 sheets per minute (300 dpi)
17	Scan Modes	Auto Colour ACS, Colour, Greyscale, Black and White
18	File Formats	JPEG, Multi/Single Page TIFF/XPS/PDF, Secure PDF, Slim PDF, Searchable PDF* (and other editable formats like DOC, XLS, RTF, TXT,PDF/A)*
19	Scan Functions	WS Scan (pull/push), Scan to USB, Scan to E-Mail, Scan to File (SMB, FTP, FTPS, IPX/SPX, local), Meta Scan*, and other
Copy		
20	Resolution	Scanning: 600 x 600 dpi, 10 bit per colour channel; Printing: 600 x 600 dpi, 8 bit per colour channel; Printing: 2,400 x 600 dpi, Black and White with smoothing and
21	First copy	Approximately 8.4 seconds Colour and Approximately 6.5 seconds Black and White
22	Zoom	Approximately 25-400% (platen glass), 25-200% (RADF*)
23	Copy Modes	Text, Text/Photo, Photo, Printed Image, Map
24	Colour Modes	Auto-Colour (ACS), Full Colour, Twin Colour, Mono Colour, Black and White
25	Colour Settings	Hue, Saturation, Colour Balance, 5 One-touch Modes, RGB Adjustment
Fax		
27	Communication	Super G3, G3 (optional 2nd line), Internet Fax T.37
28	Transmission Speed	Approximately 3 seconds per page
29	Compression	JBIG, MMR, MR, MH
30	Network Fax	Driver for Windows (32/64 bit)
31	Incoming Fax Routing	To shared folder (SMB, FTP, IPX/SPX), e-mail, e-Filing
32	Quantity	two (2)
33	**Warranty**	Minimum one (1) year

b) LCD Projector

Sr. No.	Features	Desired Technical Features
1	Type of display	Poly-silicon TFT active matrix
2	Resolution	BrightLink 480i: 1024 × 768 pixels (XGA)

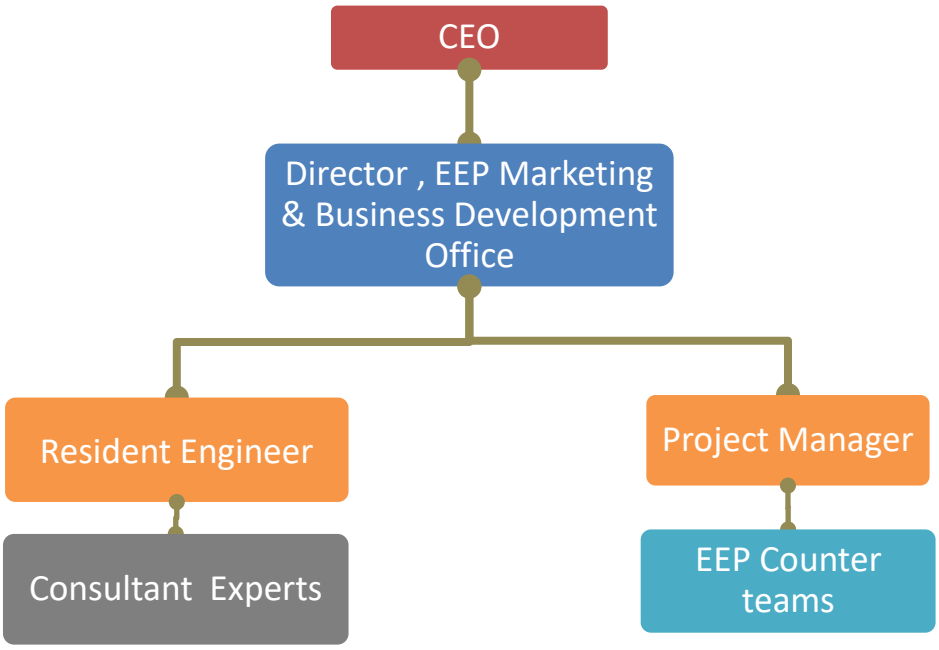
Sr. No.	Features	Desired Technical Features
		BrightLink 475Wi/485Wi: 1280 × 800 pixels (WXGA)
3	Lens	F= 1.80 Focal length: 3.71 mm
4	Color reproduction	Full color, 16.77 million colors
5	Brightness	**BrightLink 475Wi:** Normal Power Consumption mode: White light output 2600 lumens (ISO 21118 standard) Color light output 2600 lumens ECO Power Consumption mode: White light output 1800 lumens (ISO 21118 standard)
		BrightLink 480i: Normal Power Consumption mode: White light output 3000 lumens (ISO 21118 standard) Color light output 3000 lumens ECO Power Consumption mode: White light output 1800 lumens (ISO 21118 standard)
		BrightLink 485Wi: Normal Power Consumption mode: White light output 3100 lumens (ISO 21118 standard) Color light output 3100 lumens ECO Power Consumption mode: White light output 1800 lumens (ISO 21118 standard)
6	Contrast ratio	3000 to 1 with Auto Iris on and Normal Power Consumption mode
7	Image size	**BrightLink 480i:** 55.9 to 93.2 inches (1.42 to 2.37 m)
		BrightLink 475Wi/485Wi: 60 to 100 inches (1.52 to 2.54 m)
8	Projection distance	13.7 to 23.5 inches (0.35 to 0.60 m)
9	Projection methods	Front, wall or ceiling-mounted

Sr. No.	Features	Desired Technical Features
10	Optical aspect ratio (width-to-height)	**BrightLink 480i:** 4:3
		BrightLink 475Wi/485Wi: 16:10
11	Focus adjustment	Manual
12	Zoom adjustment	Digital
13	Zoom ratio(Tele-to-Wide)	1:1.35
14	Internal sound system	16 W monaural
15	Noise level	35 dB (Normal Power Consumption mode) 28 dB (ECO Power Consumption mode)
16	Keystone correction angle	Vertical: ± 5º Horizontal: ± 5º
17	USB-B port compatibility	USB 1.1 and 2.0 compliant for USB display or external mouse
18	USB-A port compatibility	One USB 1.1 and 2.0 compliant port for USB device input
19	Quantity	two (2)
20	**Warranty**	Minimum one (1) year

11. Transportation

11.1. The Client will not provide transportation for the consultant's staff. All costs shall be included in the consultants offer.

Annex 1 PIU Implementation Structure


CEO
Director , EEP Marketing & Business Development Office
Resident Engineer
Project Manager
Consultant Experts
EEP Counter teams