



WEST AFRICAN POWER POOL
SYSTEME D'ECHANGES D'ENERGIE ELECTRIQUE OUEST AFRICAIN
General Secretariat / Secrétariat Général



**330 kV WAPP NIGERIA – BENIN – TOGO – GHANA- CÔTE D'IVOIRE
DOUBLE CIRCUIT MEDIAN INTERCONNECTION PROJECT**

***TERMS OF REFERENCE (TOR) FOR
FEASIBILITY STUDY AND PREPARATION OF BIDDING DOCUMENTS***

July 2019

List of Abbreviations

AFLS	Automatic Frequency Load Shedding
CC	Combined Cycle
CEB	Communauté Electrique du Bénin
CEET	Compagnie Energie Electrique du Togo
CI-ENERGIES	Côte d'Ivoire Énergies
ECOWAS	Economic Community of West African States
EIS	Environmental Impact Statement
ERERA	ECOWAS Regional Electricity Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FCR	Frequency Control Reserve
FOTS	Fibre Optical Transmission System
GRIDCo	Ghana Grid Company
MALS	Manual Activated Load Shedding
MDR	Momentary Disturbance Reserve
OPGW	Optical Ground Wire
PHCN	Power Holding Company of Nigeria
RAP	Resettlement Action Plan
ROW	Right-Of-Way
SBEE	Société Béninoise d'Eau et d'Electricité
SCADA	Supervisory Control and Data Acquisition Systems
TCN	Transmission Company of Nigeria
TOR	Terms Of Reference
WAPP	West African Power Pool

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WEST AFRICAN POWER POOL (WAPP) SECRETARIAT

330 kV WAPP NIGERIA – BENIN – TOGO – GHANA DOUBLE CIRCUIT MEDIAN INTERCONNECTION PROJECT

TERMS OF REFERENCE FOR FEASIBILITY STUDY AND PREPARATION OF BIDDING DOCUMENTS

1.0 INTRODUCTION

1.1. Objective of WAPP

The objective of the WAPP is to establish a regional electricity market in West Africa through the judicious development and realization of key priority infrastructure that would permit the accessibility to economic energy resources, to all member states of the ECOWAS.

In order to further advance the implementation of the priority projects of the West African Power Pool (WAPP), the WAPP Secretariat and WAPP Members have commenced preparatory works towards the implementation of the following priority interconnection projects:

- 330 kV Volta (Ghana) – Lome ‘C’ (Togo) - Sakété (Benin) Interconnection project;
- 330 kV Nigeria – Togo/Benin Interconnection Reinforcement Project;
- 330 kV Nigeria – Niger – Togo/Benin – Burkina Interconnection Project;
- 330 kV Côte d’Ivoire – Ghana Interconnection Reinforcement Project.

The WAPP Secretariat on behalf of the Transmission Company of Nigeria (TCN), Communauté Electrique du Bénin (CEB) of Benin & Togo, Ghana Grid Company (GRIDCo) of Ghana and Côte d’Ivoire Énergies (CI-ENERGIES) of Côte d’Ivoire intends to procure the services of an International Consulting firm to undertake a Feasibility Study and preparation of Functional Bidding Documents for the 330 kV WAPP Nigeria – Benin – Togo – Ghana Double Circuit Median Interconnection Project.

1.2. Objective of the Proposed Project

The ECOWAS Master Plan for the Development of Regional Power Generation and Transmission Infrastructure 2019 - 2033 adopted by the ECOWAS Heads of State and Government in 2018 through Supplementary Act A/SA.4/12/18 identifies the key priority projects that need to be implemented to ensure stable integration of the national electricity networks in the ECOWAS Region and facilitate optimal power exchanges and trading among the Member States. Prominent among the infrastructure sub-programs to be developed is the WAPP Median Transmission Backbone (MTB), which seeks to establish a robust 330 kV transmission link from Shiroro in Nigeria to Ferkessedougou in Côte d’Ivoire passing through Zungeru and Kainji in Nigeria as well as Parakou in Benin, Kara in Togo, Yendi and Tamale in Ghana.

In order to increase the reliability and stability of power exchanges among the ECOWAS coastal Member States of Nigeria, Benin, Togo, Ghana, Côte d’Ivoire and beyond, the ECOWAS Master Plan has re-affirmed as priority the implementation of a second interconnection line among these

countries that shall also serve to render more optimal the power systems of the concerned national power utilities.

In addition, this second interconnection line shall also increase reliability (n-1) on the WAPP interconnected system given that it shall represent an alternate path to the 330 kV WAPP Coastal Transmission Backbone for power exchange among the countries as well as the 330 kV WAPP Northern Corridor Interconnection that is among Nigeria, Niger, Tog/Benin and Burkina. With the expected full deployment of the regional electricity market in West Africa by 2019/20, the establishment of secure and reliable transmission corridors to support market operations becomes paramount.

Furthermore, the realisation of the 330 kV WAPP Nigeria – Benin – Togo – Ghana - Côte d'Ivoire Double Circuit Median Interconnection Project shall permit the further exchange of low cost and clean power within the market given that it shall emanate from the 600 MW Shiroro Hydropower Plant in Nigeria, pass through the 700 MW Zungeru Hydropower Plant and the 760 MW Kainji Hydropower Plant both in Nigeria, and catalyse the development of the 87 MW Juale Hydropower Project in Ghana thereby increasing opportunities for trade in West Africa.

In addition, the region's renewed drive to significantly augment the portion of new Renewables (Solar, Wind) in the regional energy mix dictates that more stable and reliable transmission infrastructure connected to hydropower assets is needed to provide the necessary balancing support.

The WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES therefore intend to undertake a project that shall comprise the construction of a 330 kV double circuit high voltage transmission line from Shiroro in Nigeria to Ferkessedougou in Côte d'Ivoire passing through Zungeru and Kainji in Nigeria as well as Parakou in Benin, Kara in Togo and Yendi and Tamale in Ghana, with associated high voltage substations. This project, which would greatly facilitate the power exchanges among the countries in the West African sub-region, is known as the **330 kV Nigeria – Benin – Togo – Ghana-Côte d'Ivoire Double Circuit Median Interconnection Project**.

The project, which would be executed in Nigeria, Benin, Togo, Ghana and Côte d'Ivoire, shall indicatively result in the following among others:

- Construction of approximately 1,600 km of 330 kV high voltage double circuit transmission line;
- Extension of/or the construction of a new high voltage substation at Shiroro (Nigeria) or environ;
- Extension of/or the construction of a new high voltage substation at Zungeru (Nigeria) or environ;
- Extension of/or the construction of a new high voltage substation at Kainji (Nigeria) or environ;
- Extension of/or the construction of a new high voltage substation at Parakou (Benin) or environ;
- Extension of / or the construction of a new high voltage substation in Kara (Togo) or environ;
- Extension of / or the construction of a new high voltage substation in Yendi (Ghana) or environ;
- Extension of / or the construction of a new high voltage substation in Tamale (Ghana) or environ;
- Extension of / or the construction of a new high voltage substation in Ferkessedougou (Côte d'Ivoire) or environ;

- Installation of SCADA and fibre optic systems (OPGW);
- Electrification of eligible communities/villages along the line route of the project and around substations;
- Installation of compensation and synchronization equipment if required;
- Reinforcements of the networks of the involved WAPP Member Utilities - TCN (Nigeria), CEB (Togo-Benin), GRIDCo (Ghana), and CI-ENERGIES (Cote d'Ivoire) if necessary.

The project is at the conceptualization stage and requires a study to determine the technical feasibility and economic viability of the project done in sufficient detail that would permit the preparation of bidding documents that could include pre-qualification.

The WAPP Secretariat shall prepare a Line Route and Environmental and Social Impact Assessment Study separately by a different consultant, but in parallel with the Feasibility Study. Close collaboration between the Consultants implementing the two (2) studies shall therefore be required.

2.0 CONTEXT OF THE STUDY

2.1 Transmission Company of Nigeria

Electricity production and supply in Nigeria had been a monopoly of the federal owned Electric utility body known as National Electric Power Authority (NEPA). NEPA was charged with the responsibility for the generation, transmission, distribution and sale of electricity to customers and was run as a vertically integrated company. On 1st July 2005, NEPA was renamed Power Holding Company of Nigeria (PHCN) following the signing into law of the Electric Power Sector Act of 2005.

The Power Sector reforms of 2005 led to the unbundling of PHCN into eighteen (18) successor companies comprising six (6) Generation Companies, one (1) Transmission Company and eleven (11) Distribution Companies. The sector has also been deregulated leading to private sector participation in the generation sector and a number of IPPs are in operation in the country today. The Transmission Company of Nigeria (TCN), responsible for transmission services, has its own management.

The Nigerian Electricity Regulatory commission (NERC) had also been established in line with the Reform programmes. The NERC was established under the Nigerian Electric Power Sector Reform Act, and was passed into law in March 2005 to among others ensure orderly development of a competitive power market and promote competitive and private sector participation in the sector.

The total installed capacity in Nigeria shall be 13,473.25 MW when the National Integrated Power Project (NIPP) is completed. This was made up of 1,938.40 MW from Hydro sources (generated from the Kainji, Jebba and Shiroro hydropower plants), 5,237.6 MW from thermal sources generated from the Egbin, Sapele, Afam I-IV, Delta, Geregu, Omotosho and Olorunsogo thermal plants. 1526.25MW was generated by IPPs from Ajaokuta, Afam IV Okpai, A.E.S, Omoku and Ibom power plants and 4771MW from National Integrated Power Project (NIPP).

The high voltage transmission system as of 2015 consisted of 6,680 km of 330kV transmission lines, 9,161 km of 132 kV transmission lines, 38 Nos 330 kV Substations and 126 Nos. 132 kV

Substations. Nigeria has the following transmission interconnections between its neighbouring countries;

1. 132 kV transmission line from Northern Nigeria to Niamey in Niger – the line was constructed in 1976 and spans 260km
2. 132 kV transmission line from Katsina (Nigeria) to Gazaoua (Niger) with a distance of 103km.
3. 330 kV single circuit line from Ikeja West Substation in Lagos to Sakete Substation in the Republic of Benin near the Benin – Nigeria border; The line was commissioned in 2007 and spans 70 km between the two countries.

Nigeria has its National Control Centre in Oshogbo and has three (3) other regional control centres.

2.2 Communauté Electrique du Benin (CEB)

The Communauté Electrique du Bénin (CEB) is an international public Organization which was established by the International Agreement of July 27, 1968. By this Agreement, CEB had the monopoly of power generation and transportation in Benin and Togo and the monopoly to develop the related infrastructure.

The revised Benin-Togolese Electricity Code has attributed to CEB exclusivity in the two countries to transport, import and sole purchaser for the needs of the two countries. The revised Code has opened up power generation activities to Independent Power Producers.

CEB is the single electricity power supplier to the distribution utilities in Benin (Société Béninoise d'Energie Electrique (SBEE)) and in Togo (Compagnie Energie Electrique du Togo (CEET)) together with some large industries.

The activities of the CEB started in 1973 following the commissioning of a 161 kV interconnection between the two countries and Ghana. In 2007 a 330 kV network was commissioned to interconnect the network of CEB to that of Nigeria. In 2010, electricity import totalled 88.6% of the consumption of Togo and Benin. These were from Ghana (30.16%), Côte d'Ivoire (4.03%) and Nigeria (51.49%). The rest of the energy was produced locally. CEB currently operates the 65 MW hydroelectric power plant at Nangbéto and occasionally two (2#) 20 MW Gas Turbines, one in Lome (Togo) and the other in Cotonou (Benin). ContourGlobal an Independent Power Producer (IPP) based in Togo currently operates a Thermal Power Plant with installed capacity of 100 MW. The SBEE and CEET have made stand-by arrangements of some thermal power plants they can rely on in case of failure of supply from CEB.

The CEB interconnected network covers mostly the coastal regions, which have a high population density, and a concentration of economic and industrial activities. Facing a steady growth in demand, resulting from the development and expansion of new cities inside both countries, CEB undertook a series of studies towards:

- development of the hydroelectric potential of both countries;
- diversification of the sources of power supply through the interconnection with Nigeria, within the framework of West African Power Pool;

- expansion of the transmission system in both countries through the interconnection of the Northern regions to the coastal network of the South. On January 22nd, 2011, the Government of Benin secured financing from the Banque Ouest Africaine de Developpement (BOAD) by the Fonds de Developpement Energie (FDE) to fund the preparation and construction of the single circuit 161 kV Malanville – Kandi – Bembereke Transmission Line Project in Benin.

CEB's transmission system currently comprises of 16 km of 330 kV network, 1,624 km of 161 kV network and 97 km of 63 kV network. The addition of the 330 kV line currently under construction between Sakété substation (in Benin) and Volta substation (in Ghana) through a new substation 330/161/20 kV of Davie (in Togo) will bring to 212 km the length of the 330 kV lines and 1,669 km of 161kV lines in CEB .

2.3 Ghana Grid Company (GRIDCo)

The Ghana Grid Company (GRIDCo) was established in accordance with the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 Act 692, which provides for the establishment and exclusive operation of the National Interconnected Transmission System by an independent Utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities within the framework of the Power Sector Reforms. The company became operational on August 1, 2008 following the transfer of the core staff and power transmission assets from VRA to GRIDCo.

The main functions of GRIDCo are to among others:

- undertake economic dispatch and transmission of electricity from wholesale suppliers (generating companies) to bulk customers, which include the Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo) and the Mines;
- provide fair and non-discriminatory transmission services to all power market participants;
- acquire and manage assets, facilities and systems required to transmit electrical energy
- provide metering and billing services to bulk customers.
- carry out transmission system planning and implement necessary investments to provide the capacity to reliably transmit electric energy; and manage the Wholesale Power Market.

As at October 2017, the grid of GRIDCo was characterized by 371km of 330 kV Transmission Lines, 75km of 225 kV Transmission Lines, 4,933km of 161 kV Transmission Lines, and 133 km of 69 kV lines. The total power transformer capacity of the entire transmission network as at October 2017 was 5, 798.5 MVA.

The network of GRIDCo is integrated into the 330 kV WAPP Coastal Transmission Backbone that also includes the systems of Nigeria, Benin, Togo and Cote d'Ivoire. It is envisaged that the national system of Burkina Faso shall be interconnected with Ghana in 2018.

2.4 Côte d'Ivoire Energies (CI-ENERGIES)

The company "Côte d'Ivoire Energies", CI-ENERGIES was created in 2011 with the name "Société des Énergies de Côte d'Ivoire" through the Decree N° 2011- 472 of December 21st, 2011 with the mission, in Côte d'Ivoire and abroad, to ensure the monitoring and management of power transit as well as the project management tasks returning to the State as concessioning authority.

Historically, ‘Société Energie Electrique de Côte d’Ivoire’ (EECI) was a state-owned utility managing the whole of power system, comprising power generation, transmission and distribution until 1990.

In October 1990, the State of Côte d’Ivoire carried out a first reform of the electricity sector, reducing the missions of the EECI to the management of the service entrusted and to the development of the electricity sector then, created the ‘Compagnie Ivoirienne d’Electricité’ (CIE), a private utility to which the State awarded the operation of the power system (this concession runs until 2020).

In December 1998, the State carried out a second reform of the electricity sector which marked the termination of the EECI and its replacement by three (3) State-owned utilities:

- The National Regulatory Authority of the Electricity Sector (ANARE), responsible for monitoring the Operators of the sector, arbitration of disputes and the protection of the interests of the electricity consumer;
- The ‘Société de Gestion du Patrimoine du secteur de l’Electricité (SOGEPÉ), responsible for managing the sector's assets, managing financial flows and preparing the consolidated accounts of the sector;
- The ‘Société d’Opération Ivoirienne d’Electricité (SOPIE), responsible for monitoring power flows, studies and planning, as well as the project management of the investment projects returning to the State, in terms of renewal and extension of transmission and rural electrification networks.

In December 2011, the third reform saw the establishment of CI-ENERGIES to which the State entrusted the missions and attributions of SOGEPÉ and SOPIE. Côte d’Ivoire's transmission network consisted in 2016 of 2,469 km of 225 kV overhead lines, 2,664 km of 90 kV of overhead and underground lines, 15 substations of 225 kV and 33 substations of 90 kV.

Côte d’Ivoire has been interconnected to Ghana since 1983 by the 225 kV Abobo - Prestea line of 210 km; to Burkina Faso since 2001 with the 225 kV Ferkessedougou-Kodeni line and to Mali since 2012 with the 225 kV Ferkessedougou – Sikasso line of 237 km.

A second interconnection is planned with Ghana for 330 kV between the Bingerville substations in Côte d’Ivoire and Dunkwa-2 in Ghana for a length of 245 km. Côte d’Ivoire is also taking part in a West African Power Pool (WAPP) Project, which provides for 225 kV interconnection between Côte d’Ivoire, Liberia, Sierra Leone and Guinea Conakry, known as CLSG, with the construction of a line of more than 1,000 km between Man's 225 kV substations in Côte d’Ivoire and Linsan in Guinea Conakry.

3.0 OBJECTIVE OF TERMS OF REFERENCE (TOR)

The Objective of this TOR is to engage the services of a qualified and experienced International Consulting firm to prepare a Feasibility Study, carry out preliminary engineering design at the level of feasibility, and preparation of Bidding Document, that could include Pre-Qualification, for the “Design, Supply and Installation” Procurement of the transmission line and related substations for the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project.

4.0 SCOPE OF SERVICES

The Consultant shall undertake the Studies and provide the required services in accordance with internationally recognized practices for Consultancy Services. The Consultant shall also ensure compliance with international standards, applicable laws and regulations in the various countries (Nigeria, Togo, Benin, Ghana and Côte d'Ivoire) as well as the Funding Agencies that shall be involved in the financing of the project.

The Consultant shall keep accurate and systematic records and accounts in respect of the Services in such form and detail as is customary and as shall be sufficient to establish accurately that the costs and expenditures have been duly incurred.

As part of the Scope of Services, the Consultant shall conduct network analyses and prepare Conceptual Designs, preliminary cost estimates and implementation schedules shall be developed to provide the WAPP Secretariat and concerned countries with the requirements for the implementation of the project.

In undertaking the assignment, the Consultant shall review the latest WAPP Master Plan as well as all past systems studies conducted for the project, with the view to firming them up and investigate in detail with proposals for mitigation on among others, dynamic stability, line end voltage rise, power transfer capacity, and lightning and switching over-voltages. The Consultant shall also conduct preliminary engineering investigations that shall allow the preparation of specifications and quantities for among others, towers, foundations, insulators, conductors, in addition to substation lightning protection, arresters, and earthing arrangements suitable for inclusion in Bidding Documents.

The Consultant shall note that a Line Route and Environmental and Social Impact Assessment being implemented under a separate contract, shall form an input into the Feasibility Study and Preparation of Bidding Documents. The Consultant shall therefore collaborate closely with the Consultant preparing the Line Route and Environmental and Social Impact Assessment Study to ensure a timely completion of the Feasibility Study.

The Scope of Services shall consist of:

- A technical study on the interconnection.
- Economic and financial analyses including sensitivity analyses and a tariff proposal.
- Proposal of an Institutional Framework for the implementation of the project
- Formulation of an appropriate Commercial Framework
- Risk Analyses
- Training in project preparation and all technical aspects of the project
- Project Packaging and Preparation of Pre-Qualification and Bidding Documents.

4.1 Technical study on the interconnection.

The planning studies shall consider the relevant networks (existing and planned including generation) in Nigeria, Benin, Togo, Ghana and Côte d'Ivoire and recommend any additional facilities that would be necessary to promote exchanges of power among the five (5) countries and other WAPP networks. This shall include the necessary network reinforcements to be made in each of the countries to ensure unconstrained power exchanges among the countries and/or increase the capacities of the national networks to absorb the power coming from the Interconnection.

The scope of services to be provided by the Consultant under this phase shall include, but not be limited to the following:

- Data Collection
- System Analyses

4.1.1 Data Collection and Review

Following the kick off meeting, the Consultant shall immediately proceed with the data collection exercise. The Consultant shall gather, review and compile all relevant technical, economic and cost data on the Nigeria, Benin, Togo, Ghana and Cote d'Ivoire networks necessary for the conduct of the study. The Consultant shall review all existing available reports that could contribute in preparing the Feasibility Study. The data shall include but not be limited to:

- a) Loads, load factors and load forecasts,
- b) Population and electricity access rates,
- c) Generation and transmission facilities in the interconnected systems,
- d) Generation and transmission system expansion plans,
- e) Projected levels of power exchanges between the four (4) utilities and the WAPP interconnected system,
- f) Current System Operating conditions,
- g) Single line diagrams, site plans, layout drawings, protection schemes, types of circuit breakers and their transfer ratings for the required high voltage substations in all the countries involved,
- h) Conductor sizes and tower designs for high voltage transmission lines in the electricity networks of the five (5) countries.

In proposing designs for the transmission towers, the Consultant shall collect reports on testing of the various types of towers and conductors for 330 kV transmission lines. The Consultant shall maintain contact with TCN, CEB, GRIDCo, CI-ENERGIES and the WAPP Secretariat to ensure that the most recent data are collected. The Consultant in conjunction with WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES shall analyse the use of these towers for the construction of the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d'Ivoire Double Circuit Median Interconnection Project, make cost-benefit analyses, and elaborate on the risks involved.

In the case where the required data is not available, the Consultant shall use his best judgement based on acceptable international practise to provide substitute data. The Consultant shall however provide a justification for the choice of data in the Data Report.

As part of the 'Data collection' exercise, the Consultant shall also collect and present information relating to the prevailing Institutional and Financial state of the power sectors in each country in the Data Report. The Consultant shall furthermore catalogue any ongoing institutional reforms in the electricity subsectors of the concerned countries and take these into account in proposing an appropriate institutional framework to implement the project.

The Consultant shall review all existing reports that could contribute in preparing the Feasibility Study.

All the information collected by the Consultant shall be submitted as part of the submissions on the Data Collection Report.

4.1.2 System Analyses

The Consultant shall perform planning studies, which shall seamlessly integrate the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project into the WAPP interconnected system to determine the impact of the line on system operation and power exchanges among the five (5) countries and the WAPP interconnected system over a planning horizon of 20 years and 5-yr intervals. The Consultant shall analyse the impact of the project on the existing networks in Nigeria, Benin, Togo, Ghana and Côte d’Ivoire. The Consultant shall also evaluate the impact of the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project on the WAPP Interconnected System. The Consultant shall furthermore analyse the adequacy of the existing transmission and generation capacities and the transmission and generation expansion plans of the five (5) countries over the planning horizon and make recommendation on reinforcement projects required. The Consultant shall provide at the very least, a cost estimate and implementation schedule for each reinforcement identified. The Consultant should also investigate the possibility of other alternatives that could result in the least cost interconnection among Nigeria, Benin, Togo, Ghana and Côte d’Ivoire.

The Consultant shall undertake, among other things, the following:

- Review of data on generation and transmission facilities including communications and SCADA systems in the interconnected networks of the five (5) countries.
- Perform load flow calculations to establish the maximum transfer capacity of the interconnection during steady state and transient conditions, and recommend methods of increasing the transfer limits and stability margins of the interconnected system. Voltage regulating equipment such as capacitor banks, SVCs, Power system stabilizers, could be employed;
- Perform static, dynamic and transient stability studies at 5-yr intervals, to establish among others, the levels of inter-area oscillations in the interconnected system and propose possible remedies.
- Calculate system losses for different transit alternatives;
- Analyse the effect that the different alternatives shall have on the steady state performance and transient and dynamic stability of the interconnected system;
- Calculate fault levels in the interconnected systems and recommend measures to ensure that fault levels do not exceed the breaking capacity of protection equipment already installed and do not propagate into individual or other systems.
- Perform system security analysis to establish strategies for maintaining acceptable operating conditions during normal operation and to secure the system during disturbances. Concepts such as Frequency Control Reserve (FCR), Momentary Disturbance Reserve (MDR), Automatic Frequency Load Shedding (AFLS) and Manual Activated Load Shedding (MALs) could be employed.
- Perform switching studies to determine receiving-end voltages and propose the necessary compensation for maintaining the voltages within acceptable limits.
- Catalogue for each country and on an annual basis, how the energy and power requirements are being met over the planning horizon.

- Identify the network reinforcements required at the national level (transmission and sub-transmission) to improve power exchanges/delivery through the project.

In order to ensure consistency in the models to be developed by the Consultant in conducting the system analyses, the Consultant shall ensure that the network analyses are conducted in conjunction with experts from each of the utilities. In developing the network model within the framework of this project, the Consultant shall consult the latest model on the WAPP interconnected system. In these regards, the Consultant shall invite to his Home Office, one (1) expert knowledgeable in network analyses from each utility and WAPP Secretariat to review and discuss the developed model and the preliminary results of the network analyses. The proposal of the Consultant shall assume that this exercise shall not be less than one (1) week and shall include all associated costs of participation of the experts (including but not limited to transportation, subsistence, accommodation).

As part of the system analyses, the Consultant shall conduct detailed analyses on transmission losses to determine increases in losses in the concerned countries attributable to various export/import scenarios.

The Consultant shall in particular, assess the possibility of loop flows among the concerned countries and propose possible solutions to address the situation if such is the case.

4.2 Preliminary Engineering and Preparation of Specifications for Equipment and Works

The services of the Consultant in this study shall include all preliminary engineering investigation which shall define the functional technical specifications of the envisaged equipment and works for the complete integration of the interconnection line into the existing systems, the required associated substations, and the SCADA and required communications systems suitable for preparing Design, Supply and Installation Bidding documents with Pre-qualification if necessary. In proposing a preliminary design and associated functional specifications, the Consultant shall consider alternatives and provide justification for the design based on techno-economic and cost-benefit analyses, in particular the towers, conductors (type and bundle configurations) and insulators. The Consultant shall also integrate the requirements of the WAPP Information and Coordination Center. The Consultant shall furthermore consider the operation and maintenance requirements of TCN, CEB, GRIDCo and CI-ENERGIES in the development of the preliminary design and functional technical specifications and shall evaluate the consequences of the design on the systems of TCN, CEB, GRIDCo and CI-ENERGIES.

The preliminary engineering investigation shall also enable the selection of design criteria and result in a preliminary design for the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project that shall ensure the complete and seamless integration of the Project into the WAPP Interconnected System as well as the national power systems, including the Dispatch and/or Control Centers. In effect, the scope of work of the Consultant shall include all the necessary work (including the preparation of the Bidding Documents) that ensures that each concerned national dispatch/control center (as well as the WAPP Information and Coordination Center if required) can “see” and manage its component of the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project.

The Consultant shall identify the basic issues that shall be addressed in the study in order to ensure that the interconnection project is economically efficient (minimum total life cycle cost while meeting certain minimum standards) and that all individual sub-projects have consistent technical standards. The Consultant shall then analyze the issues related to the interconnection project, and shall establish functional specifications and design criteria for the interconnection project. The basic design studies shall be related to conceptual (primary voltage level), electrical (equipment, substation sizing, conductors, protection system), civil (tower structures, hardware, insulators, type of foundation), quality of service (voltage, frequency, reliability, phase imbalance, harmonic distortion, stability) and SCADA (communications, tele-protection schemes).

Based on the data review exercise, the preliminary engineering investigations and any other relevant basis, the Consultant shall then propose functional specifications and a preliminary design for the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d’Ivoire Double Circuit Median Interconnection Project that ensures the effective integration of the project into the entire existing systems, including the national dispatch centers (as well as the WAPP Information and Coordination Center if required), and takes into consideration all relevant issues that include but not limited to:

4.2.1 Interconnection Line

a. Technical Conditions that include but not limited to:

- Engineering Conditions taking into consideration relevant international, national and the utility’s own standards.
- Ambient Conditions taking into consideration humidity, keraunic levels, thermal resistivity and quality of soil, pollution level, wind speed etc
- System Conditions taking into consideration frequencies of systems and their compatibility, short circuit levels, grounding systems, communications systems including fibre optic (OPGW) and SCADA systems and their compatibility etc.

b. Technical Requirements that include but not limited to:

- Transmission capacity (optimization of the type of conductor and bundle) at given conditions taking into consideration voltage control, reactive power production;
- Double Circuit design of transmission line
- Synchronizing capacity taking into consideration voltage control, reactive losses,
- System Reliability taking into consideration various fault scenarios, lightening protection, insulation co-ordination, stability, load flow,
- Dependability taking into consideration availability, maintainability, adequacy of structures and conductors,
- Loss Optimization taking into consideration no-load, load, reactive,
- Environmental aspects taking into consideration electrical noise, visual impact, acoustic noise, electric and magnetic field influence, use of land / right-of-ways
- Electrification of communities/villages along the line route possibly through shield-wire or other technology;
- Public and Personnel safety issues taking into consideration protection, safety of operation
- WAPP Operations Manual

In proposing a design, the Consultant shall also integrate, where appropriate and relevant, the

guidance given in ¹Cigre's "Guide to Overall Line Design – Working Group B2.51, December 2015" annexed to this ToR. The Consultant shall also propose a detailed list of recommended spare parts that shall be included in the bidding documents.

4.2.2 Substations

For the required associated substations, the Consultant shall have to first of all determine, in consultation with the concerned utilities and in consideration of the Line route and ESIA Study, whether new substations shall have to be created or whether existing substations shall have to be extended. In case of the extension of substations, the Consultant shall have to study, estimate and examine the extensions to be done and the configuration of the existing substations to appropriately position the arrival of the transmission lines. The evaluation shall have to take into account among others:

- The available space for the protection and control equipment, energy meters, telecommunication panels and electrical auxiliary fittings, etc. ;
- The available space in the cable trenches ;
- The capacity of the existing equipment to support an increase of the load of the substation and higher fault current;
- The capacity of the ground Grid of the substation to support higher ground fault current.

The Consultant shall also take into consideration among others:

a. Technical Conditions that include but not limited to:

- Engineering Conditions taking into consideration relevant international, national and the utility's own standards.
- Ambient Conditions taking into consideration humidity, keraunic levels, thermal resistivity and quality of soil, pollution level, wind speed etc
- System Conditions taking into consideration frequencies of systems and their compatibility, short circuit levels, grounding systems, communications systems including fibre optic and SCADA systems and their compatibility etc.

b. Technical Requirements that include but not limited to:

- Transmission capacity at given conditions taking into consideration voltage control, reactive power production;
- Synchronizing capacity taking into consideration voltage control, reactive losses,
- System Reliability taking into consideration various fault scenarios, lightening protection, insulation co-ordination, stability, load flow,
- Dependability taking into consideration availability, maintainability,
- Loss optimization taking into consideration no-load, load, reactive,
- Environmental aspects taking into consideration electrical noise, visual impact, acoustic noise, electric and magnetic field influence, use of land / right-of-ways
- Electrification of communities/villages along the line route possibly through shield-wire or other technology;

¹ Conseil international des grands réseaux électriques , International Council on Large Electric Systems

- Public and Personnel safety issues taking into consideration protection, safety of operation
- WAPP Operations Manual.

The Consultant shall also propose a detailed list of recommended spare parts that shall be included in the bidding documents.

4.2.3 *Communication and SCADA Systems*

Communication including tele-protection schemes and supervisory control and data acquisition systems (SCADA) exist in the networks. The Consultant shall review the existing systems and if found adequate, propose the extension of these systems to cover the new works. If found inadequate, the Consultant shall make an appropriate proposal that shall include the reinforcement/upgrade of the existing systems in consultation with the concerned utilities. In any case, the Consultant shall ensure full and seamless connectivity between the proposed infrastructure/project and the existing national Dispatch Centers. All proposed extensions shall be digital systems. The Consultant shall also take into consideration the ongoing development of the WAPP Information and Coordination Center, the stipulations in the WAPP Operations Manual and ensure compatibility with the systems proposed.

The Consultant shall ensure that the project integrates seamlessly into the existing interconnected system and that the proposed communication and SCADA systems are compatible with the existing systems as well as guarantee effective communication between the two systems. The use of Fibre Optical Transmission System (FOTS) based on Optical Ground Wire (OPGW) on the high voltage line should be considered as the primary communication channel. PLC shall then be used as backup for the FOTS.

4.2.4 *Electrification of Communities/Towns/Villages along line route and around substations*

As a Social Mitigation Measure and to increase acceptability of the project by the populations in the vicinity of the project, it is envisaged that all communities/towns/villages which are located five (5) kilometres on each side of the transmission lines and having populations between 500 and 2,500 inhabitants could become Beneficiaries of an electrification scheme. This electrification could be done through conventional means (medium voltage outlets from the Substations to be constructed under the project), extensions from nearby distribution systems, and/or shield-wire technology (SWS). Very close collaboration with the Consultant preparing the Line Route and Environmental and Social Impact Assessment Study shall be required.

On the basis of a list of communities to be established by the Consultant preparing the Line Route and Environmental and Social Impact Assessment Study in conjunction with the involved national power utilities, the Consultant shall, in close collaboration with the concerned utilities, make a detailed and justified proposal for achieving the electrification of the identified communities.

In this respect, the scope of services to be provided by the Consultant shall include but not be limited to:

- Data collection and review and description of the methodology to prepare this part of the assignment;
- Justified recommendation on technology mode of electrification of each community/town/village;
- Proposal on least cost solution to achieve electrification including cost estimate.

4.2.4.1 Data collection and review and description of the methodology

Following the kick off meeting, the Consultant shall immediately proceed with the data collection exercise. The Consultant shall gather, review and compile all relevant technical, institutional, economic and cost data on the Nigeria, Benin, Togo, Ghana and Cote d'Ivoire distribution and rural networks necessary for the conduct of the study. The Consultant shall review all existing available reports/studies that could contribute in preparing this part of the Assignment. As part of the data collection, the Consultant shall investigate whether some of the communities/towns/villages that are on the agreed list are subject of other ongoing electrification schemes being implemented by the involved countries. In the case where the required data is not available, the Consultant shall use his best judgement based on acceptable international practise to provide substitute data. The Consultant shall however provide a justification for the choice of data in the Data Report. All the information collected by the Consultant shall be submitted as part of the submissions on the Data Collection Report but as a separate Volume. The Consultant shall also describe in this separate Volume, the envisaged methodology for conducting this part of the Assignment if different from the one presented during the kick off meeting. The amended methodology shall be validated during the meeting to review the draft Data Report

The Consultant shall note that the list of communities/towns/villages eligible for electrification shall be proposed by the Consultant preparing the Line Route and ESIA Study. The validated list of communities/towns/villages shall be submitted during the meeting to review the draft Data Report. This list shall be contained in the Final Data Report of the Consultant.

4.2.4.2 Justified Recommendation on technology mode of electrification of each community/town/village

On the basis of the list of communities/towns/villages, the Consultant shall:

- Determine the approximate energy demand, over the period of the study, of each community/town/village based on the population and public infrastructure that include but not be limited to Government/local administration offices, education and health facilities, as well as water supply installations.
- Determine the most optimal technology solution for providing electricity to each community/town/village through conventional means (medium voltage outlets from the Substations to be constructed under the project), extensions from nearby distribution systems, and/or shield-wire technology (SWS). The Consultant shall also investigate whether some of the communities/towns/villages that are on the agreed list are subject of other ongoing electrification schemes being implemented by the involved countries. In determining the optimal solution, the Consultant shall highlight the

advantages and disadvantages of each of the afore-mentioned schemes. The Consultant shall also do a cost/benefit analyses of each of the afore-mentioned schemes and make a justified recommendation. The cost for each scheme should be life-cycle, and shall cover among others cost estimations for the infrastructure (medium voltage, low voltage, customer service connections, street lighting), environmental and social impact, as well as operation and maintenance.

- Make a recommendation, based on the outcomes of the above-indicated analyses, as to the least cost optimal solution for achieving the electrification of the communities/towns/villages.

The outcomes of this work, including the recommendation of the Consultant, shall be submitted as part of the Preliminary Feasibility Report but in a separate Volume.

4.2.4.3 Proposal on least cost optimal solution for achieving electrification of each community/town/village

Upon adoption of the Recommendation by the stakeholders during the seminar to examine the Preliminary Feasibility Study Report, the Consultant shall prepare a Proposal for achieving the electrification of the communities/towns/villages. In this regard, the Consultant shall:

- Describe in detail the least cost optimal solution;
- Identify jointly with the Consultant preparing the Line Route and ESIA Study for the 330 kV WAPP Median Backbone Project, provisional line routes for the medium voltage networks as well as locations for the required medium voltage substations. The identification of the provisional line routes shall be in conformity with the requirements stipulated in the relevant part of the Terms of Reference of the consultant conducting the Line Route and ESIA Study;
- Prepare preliminary designs, specifications and indicative bills of quantities for the medium and low voltage systems as well as customer service connections and street lighting that shall be needed for the complete electrification of the communities/towns/villages in line with the requirements of the concerned utilities. For SWS technology, the Consultant shall specify the requirements on the 330 kV Transmission lines (tower outlines, earth-wire and OPGW, insulator) and the required equipment in the 330 kV substations;
- Prepare all the necessary layout drawings and maps for each community, showing in sufficient detail, the proposed medium voltage and low voltage systems that shall be required to achieve the electrification from the 330 kV Transmission Line and/or substation;
- Prepare cost estimates for the retained electrification scheme, broken down per country and including supervision cost for project procurement and implementation as well as the costs associated with the environmental and social impacts. The costs associated with the environmental and social impacts shall be determined by the Consultant preparing the Line Route and Environmental and Social Impact Assessment Study. The Consultant shall note that the cost of the electrification scheme shall be part of the global project cost but as a separate item;

- Highlight the socio-economic benefits of implementing the electrification of the identified communities/towns/villages, including an indication of the economic viability of the electrification scheme.

The outcomes of this work shall be submitted as part of the Provisional Feasibility Study Report but as a separate Volume.

4.2.5 Preparation of Drawings.

The Consultant shall prepare all drawings related to the preliminary engineering of the project as well as the component related to the electrification of communities along the line route. All costs associated with the procurement and preparation of the maps and drawings shall be deemed to be included in the Financial Proposal of the Consultant.

4.2.6 Implementation Schedule

The Consultant shall prepare an indicative Project Implementation Schedule highlighting all key milestones to be achieved and that clearly indicates the commissioning date of the project. In preparing the Schedule, the Consultant shall highlight the impacts of any identified network reinforcements on the implementation of the project.

4.3 Economic and Financial Analyses

The Objective of the present study is to determine the financial and economic viability of the Interconnection Project, its developmental impact, and provide pertinent and sufficient justification for the realization of the project.

The Consultant shall prepare detailed cost estimates of the Interconnection Project, broken down into country that include the costs associated with the outcomes of ESIA Study (ESMP, RAP, etc) and if necessary, the required national reinforcements.

The Consultant shall evaluate and compare the ²costs and benefits of the project against alternative scenarios so as to determine the economic and financial profitability of the project per country and the region, as well as the rationale for public financing of the project. The benefits resulting from the interconnection project shall be measured using the "with and without" concept with detailed explanation of the analyses and assumptions made especially with regards to "avoided costs". In particular, net benefits shall be calculated by comparing total system costs and benefits of the "with project" scenario with those of the "without project" scenario, with the counterfactual assumptions clearly shown. Un-quantifiable benefits shall be discussed qualitatively. Costs associated with the least cost plan shall be adjusted as necessary with due regard to alterations necessary to the individual plans. Among other indices to be calculated, the Consultant shall compute the Economic Net Present Value (ENPV), Financial Net Present Value (FNPV), Financial Internal Rate of Return (FIRR) and Economic Internal Rate of Return (EIRR) of the project, conduct sensitivity analyses and explain in detail the results. For the project economic viability and in consideration of hurdle rates (and by determining switching values), sensitivity analyses shall be conducted on among others, transit on the interconnector, capital cost, fuel cost (Gas, Diesel), and Commercial Operation Date. Similarly, for the project financial

² The economic analysis shall be consistent with the following guidelines of the World Bank: i) Operational Policy and Bank Procedure 10.00, Investment Project Financing, ii) Power Sector Policy and Investment Projects: Guidelines for Economic Analysis, iii) Social Value of Carbon in Project Appraisal 2014 and (iv) Discounting Costs and Benefits in Economic Analysis of World Bank Projects 2016.

viability and by determining switching values, sensitivity analyses shall be conducted on among others, Capex, O&M, Tariff, Load Factor, Losses and revenue collection rate.

The Consultant shall also highlight the developmental impact of the project for the countries concerned as well as the ECOWAS region. In this regard, the Consultant shall conduct distributional analyses in order to determine among others, the distribution of Cost and Benefits among Stakeholders.

The Consultant, in consultation with the WAPP Secretariat, concerned countries and Funding Agencies that shall be involved in the project, shall prepare an elaborate Financing Plan for the project. The Financial analysis should take into consideration the Financing Plan as well as the WAPP Transmission Tariff Methodology, and propose a Levelized Transmission Cost (LTC) that shall make the project financially viable and guarantee a return on investment that would be acceptable for the project to be completed. The proposal on the LTC shall take into consideration the relevant requirements of the ECOWAS Regional Electricity Regulatory Authority (ERERA), in particular, the WAPP Transmission Tariff Methodology. In addition, the Economic and Financial analyses including a LTC Proposal and sensitivity analyses shall be done taking into consideration among others, load forecasts, generation costs, generation and transmission expansion plans, capital costs, the envisaged mode of operation, project implementation delays, and economic parameters. The analyses, which shall include the development of appropriate models, shall affirm the economic and financial viability of the Interconnection Project.

The Consultant shall prepare a detailed manual of use for the financial model to be developed by the Consultant in establishing the financial viability of the project. The Consultant shall provide detailed explanations on the functioning of the model and the manual during the training in the Consultant's Home Office and also effectively transfer these with full functionality and capable of being completely edited/modified. The Consultant shall note that the model shall only be considered as final upon examination and adoption by the national utilities and Funding Agencies that shall be involved in the project. As part of the approval process, the Consultant may be required to make amendments to the model to incorporate comments and reactions from the national utilities and the Funding Agencies.

The Consultant shall also assess the applicability of Carbon-financing and Clean Development Mechanisms to the project and shall make a detailed proposal in this respect with a view to expanding funding possibilities for the project. In this regard, the Consultant shall compute and value the Greenhouse Gas emissions of the project in conformity with the World Bank's Guidance on the Social Value of Carbon as well as the Guidance on the Greenhouse Gas Accounting for Energy Investment Operations.

4.4 Institutional Framework

The Consultant shall, on the bases of available information and his knowledge, propose an appropriate institutional framework and organization to be put in place that shall among others, minimize the risks of the project not being implemented within the best conditions of cost and time, and facilitate the coordinated operation of the interconnection when commissioned. In proposing the appropriate institutional framework, the Consultant shall among others:

- Compare and contrast the suitability of traditional and single-entity models (such as SOGEM, CEB, WAGP, TRANSCO CLSG, Northcore) for the implementation and operation of regional projects;
- Analyse the prevailing relevant institutional frameworks in each of the concerned countries;

- Consider the Supplementary Act A/SA. 03/01/08 by the ECOWAS Heads of State and Government relating to the WAPP Transmission Line Implementation Strategy;
- Review in detail the institutional frameworks adopted for similar regional projects such as the 225 kV WAPP Cote d'Ivoire – Liberia – Sierra Leone – Guinea Interconnection Project, the 225 kV WAPP Guinea – Mali Interconnection Project, the 330 kV WAPP Northcore Project and other, and make appropriate recommendation as to their applicability to the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d'Ivoire Double Circuit Median Interconnection Project.

The outcomes of this exercise shall be submitted as a separate Report and shall be considered for adoption during the examination of the Draft Data Report. The related separate Volume in the Final Data Report shall be subsequently presented to a meeting of among others, the Directors General and Chief Executives of the concerned utilities for their consideration.

On the basis of the institutional framework adopted by the five countries, the Consultant shall proceed to prepare if necessary, all the legal documents and Agreements that shall be required to effectively deploy the adopted framework as well as the Organizational Requirements with related costs for deployment and functioning. The Consultant shall assume in their proposal that up to eight (8) consultation meetings, each lasting four (4) meeting days, shall be held in the concerned countries to review and finalise the legal documents and Agreements. The Consultant in their Proposals, shall, in line with WAPP Secretariat practice, discharge the WAPP Secretariat, Ministries in charge of energy and national utilities all associated costs related to the organisation of these consultation meetings (including but not limited to venue, simultaneous interpretation) and the full costs of participation of six (6) participants from each country and four (4) participants from the WAPP Secretariat (including but not limited to transportation, subsistence, accommodation).

4.5 Commercial Framework

The primary Objective of this part of the Feasibility Study is to develop an appropriate commercial framework, including tariff proposal that would govern the 330 kV WAPP Nigeria – Benin – Togo – Ghana – Côte d'Ivoire Double Circuit Median Interconnection Project and prepare all necessary contract documentation, including Power Purchase Agreements and Transmission Service Agreements, required to fully deploy the commercial framework on the Interconnection Project.

The Consultant shall note that Commercial Agreements currently exist among some of the concerned utilities. As part of the submission of the Data Collection Report, the Consultant shall include an in-depth review of the Commercial Agreements and make recommendation on its applicability on the Interconnection Project taking into consideration the prevailing context in which the project is being developed and the advent of the regional electricity market.

If the existing Commercial Agreement is deemed applicable, the Consultant shall propose an amended Commercial Agreement with language that effectively integrates the adopted outcomes of this Feasibility Study, in particular, the financial analyses, Tariff proposals, and the prevailing related institutional frameworks in each of the countries. In proposing the amendments, the Consultant shall among others:

- Determine, describe and quantify from the system analyses, the available power for exchange / the available power that each utility can contract through the interconnection and the demand requirements;

- Undertake due diligence missions in Nigeria, Benin, Togo, Ghana and Côte d'Ivoire to among others, catalogue all the issues that need to be negotiated, necessary documentation to be prepared and approved in order to establish an appropriate commercial framework for the Interconnection Project;
- Review existing commercial contracts (Power Purchase Agreements, Transmission Service Agreements) governing existing interconnections projects involving Nigeria, Benin, Togo, Ghana and Côte d'Ivoire;
- Hold consultation discussions with among others, TCN, CEB, GRIDCo, CI-ENERGIES, the national electricity regulatory authorities of the five (5) countries, WAPP Secretariat, ERERA and the potential Funding Agencies that shall be involved in the financing of the project in order to define a suitable commercial framework;
- Determine, describe and quantify from the system analyses, the available power for exchange / the available power that can be contracted through the interconnection project and the demand requirements;
- Highlight the types of services that would be governed by the commercial framework (such as firm energy supply, reserve capacity), and the requirements for sharing of technical and commercial information, billing and settlement procedures
- Propose a mechanism to review tariffs, which shall take into consideration among others, capital costs, O&M costs, replacement costs, WAPP Transmission Tariff Methodology, and requirements of ERERA;
- Propose an amended and/or new Commercial Agreement(s) (with tracking to facilitate review) that effectively integrates the adopted outcomes of this Feasibility Study, in particular, the financial analyses, Tariff proposals, and the prevailing related institutional frameworks in each of the countries

In the event an amendment to the existing Commercial Agreement is deemed inadequate, the Consultant shall prepare, participate in discussions and finalise all the necessary Agreement(s) required to establish an effective Commercial Framework (including but not limited to Power Purchase Agreement (s), Transmission Service Agreement (s) that would govern the Interconnection Project and takes into consideration the above-mentioned.

The amended / new Commercial Agreement(s) proposed by the Consultant shall be part of the submissions of the Feasibility Study Report but in a separate Volume to facilitate their review and adoption.

The Consultant shall also within the framework of the Assignment,

- Participate in discussions on the Commercial Agreement(s) and finalize in line with the outcomes of the discussions
- Participate in the negotiations on the Commercial Agreement(s) as a Resource Person.

4.6 Risk Analyses

The Consultant, through Monte Carlo simulation or similar, shall identify and evaluate threats to the project other than environmental risks and shall recommend appropriate measures to forestall degradation or justify the primary objectives of the project with regard to deadlines, costs and technical specifications during the implementation stage and performance during the operational phase.

This analysis shall include the following:

- Identifying potential risks and categorising such risks according to their:
 - relation to the project: internal or external;
 - nature: political, economic, institutional, legal, technical, organisational, financial risks, etc;
 - origin: Sub-Contractors, Public Authorities, Donors, Consumers, etc;
 - impact: cost overruns, non-compliance with deadlines and technical specifications, delays in Commercial Operation Date, counter-productive operations, foreseen revenue collection.
- Quantitative risk analysis with a view to evaluating the direct and indirect impacts on the objectives of the project and the probabilities of their occurrences. This assessment may be completed with a qualitative analysis;
- Proposing measures for preventing risks and reducing their impacts, any eventual emergency plan scenarios, a definition of the duties and responsibilities for risk management.

The Consultant shall propose an appropriate implementation strategy for the project that mitigates against the risks identified and provides contingency scenarios that would allow for the complete execution of the project.

4.7 Training

Training is envisaged as part of the services to be provided by the Consultant in both English and French. To this end, each utility shall provide two (2) counterpart staff and the WAPP Secretariat shall provide two (2) staff.

The training shall be done through transfer of know-how on the ground and in the home office of the Consultant. In each of the five (5) countries, the Consultant shall integrate the two (2) counterpart staff provided by each utility into his team and shall work closely with them during the different phases of the Project.

The training in the offices of the Consultant shall also include one (1) participant from the Ministry in charge of Energy in each country in addition to the two (2) counterpart staff provided by each utility and three (3) participants from the WAPP Secretariat. The training in the offices of the Consultant shall be conducted after receipt of the preliminary Feasibility Study Report by the WAPP Secretariat and the concerned Utilities.

The Consultant's proposals shall include the details of the Training Program and shall discharge the WAPP Secretariat, Ministries in charge of energy and concerned utilities of all costs (including but not limited to transportation, subsistence, simultaneous interpretation, accommodation) associated with providing the training in the offices of the Consultant, which shall not be less than two (2) weeks. The proposal of the Consultant shall also show the approach and methodology that shall be employed to achieve effective transfer of knowledge to the counterpart staff. The Training Program shall include, but not limited to:

- Model and methodology employed in the performance of the economic and financial analyses and software used. The analyses conducted on the Project shall be comprehensively demonstrated during the training program
- Model and methodology employed in the technical analysis of the interconnection and software used. The analyses conducted on the Project shall be comprehensively demonstrated during

- the training program
- Selection of the design criteria, design of the interconnection line and substations including equipment selection and specifications as well as software used
- Issues that require integration into the Commercial Agreement
- Site Visits

The proposal shall therefore also include costs associated with the full transfer of hardware and software to the WAPP Secretariat and each of the utilities and Ministries in charge of energy of the different software including models used within the framework of the technical, economic and financial studies to ensure their maximum benefit. At the conclusion of the training the Consultant shall submit a comprehensive report on the training conducted as part of the Monthly Report for the month in which the training was conducted.

4.8 Project Packaging and Preparation of Pre-Qualification and functional Bidding Documents

The Consultant shall prepare and present an indicative financing plan and a project packaging to meetings of Partners that shall be organized by the WAPP Secretariat to mobilize financing for the implementation of the project. Following the adoption of the financing plan and packaging, the Consultant shall prepare functional bidding documents in line with the procurement guidelines and standard bidding documents of the Funding Agency(ies) that shall be involved in the project, including Pre-Qualification documents if necessary. The preparation of the Bidding Documents shall be done in line with the approved Financing Plan for the project. The draft and final Bidding Documents shall be delivered in a form and formatting acceptable to the Client and the Funding Agency(ies) involved in the project. The Bidding documents shall be adequate for “Design, Supply and Install” procurement and shall include well-defined functional specifications. The Bidding documents shall also be suitable for separate procurement of the project by each country involved if necessary. Subject to conformity with the requirements of the Funding Agencies that shall be involved in the project, the Bidding Documents shall contain, but not limited to the following:

- Invitation for Bids
- Instructions to Bidders
- General Conditions of Contract
- Special Conditions of Contract
- Technical Functional Specifications
- Drawings of format that conforms to the requirements of the Funding Agency(ies), utilities and permits performance based procurement.
- Implementation Schedule
- Indicative Bill of Quantities

The Consultant shall propose an adequate packaging of the Project that shall be broken down per country if necessary and shall be in line with the requirements of the Funding Agencies involved in the project. Detailed designs and drawings shall be prepared by the Contractor under “Design, Supply and Install” procurement for the plant and equipment. The Consultant shall specify the detailed drawings to be submitted by prospective Contractors.

5.0 DURATION OF STUDY & SCHEDULE

The duration for executing the Services shall not exceed 62 weeks. The Consultant shall propose in their offer, a detailed implementation schedule for the consultancy and should take into consideration that the services shall commence upon receipt of the Provisional Line Route Study Report from the WAPP Secretariat which shall be performed under a separate contract.

In this regard, the following indicative schedule is proposed:

<u>Milestone</u>	<u>Date</u>
Date of Commencement of Services	W_0
Submission of Inception Report	$W_0 + 4$ weeks
Submission of Draft Data Report	$W_0 + 6$ weeks
Submission of Preliminary Report on Proposed Institutional Framework	$W_0 + 6$ weeks
Submission of Comments on Draft Data Report (Seminar)	$W_0 + 9$ weeks
Submission of Comments on the Preliminary Report on Inst. Framework	$W_0 + 9$ weeks
Submission of Final Data Report	$W_0 + 11$ weeks
Submission of Provisional Report on Institutional Framework	$W_0 + 11$ weeks
Submission of Comments by the Directors General and Chief Executives on the Provisional Report on Institutional Framework (Seminar)	$W_0 + 17$ weeks
Submission of Draft Final Report on Institutional Framework	$W_0 + 19$ weeks
Submission of Preliminary Feasibility Study Report	$W_0 + 19$ weeks
Training Session in Consultant's Home Office commences	$W_0 + 20$ weeks
Training Session in Consultant's Home Office concludes	$W_0 + 22$ weeks
Submission of Revised Preliminary Feasibility Study Report	$W_0 + 24$ weeks
Submission of Comments on Revised Preliminary Feasibility Study Report (Seminar)	$W_0 + 26$ weeks
Submission of Draft Final Feasibility Study Report	$W_0 + 28$ weeks.
Submission of Comments on Draft Final Feasibility Study Report (Seminar)	$W_0 + 30$ weeks
Submission of Comments on Draft Final Report on Institutional Framework (Seminar)	$W_0 + 30$ weeks
Submission of Final Report on Institutional Framework	$W_0 + 32$ weeks
Submission of Final Feasibility Study Report	$W_0 + 32$ weeks
³ Donor Roundtable Meeting	$W_0 + 36$ weeks
Submission of Draft Final Bidding documents	$W_0 + 48$ weeks.
Submission of Comments on Draft Final Bidding documents	$W_0 + 50$ weeks
Submission of Final Bidding documents	$W_0 + 56$ weeks.
Submission of Draft Project Completion Report	$W_0 + 58$ weeks.
Submission of Comments on Draft Project Completion Report	$W_0 + 60$ weeks
Submission of Final Project Completion Report	$W_0 + 62$ weeks.

³ The exact date shall be confirmed by the WAPP.

The Consultant shall note that reports are considered “final” only when the Client, countries involved and Funding Agency (ies) have given their approval.

6.0 DELIVERABLES

The services include the preparation and submission of all documents and reports in a **timely manner**. All documents and reports shall be prepared in **English and French**, and shall be submitted simultaneously to the concerned Ministries in charge of Energy, TCN, CEB, GRIDCo, CI-ENERGIES and WAPP Secretariat. The reports shall be submitted under cover of official letter from the WAPP Secretariat.

The Consultant shall make provisions in his proposals to organize and take part in all meetings and seminars in collaboration with WAPP Secretariat to present the methodology and work schedule as well as all draft versions of reports to facilitate collation of comments with particular reference to (i) kick-off meeting of the Feasibility Study (2 meeting days) (ii) Draft Data Report (3 meeting days), (iii) Preliminary Feasibility Study Report (4 meeting days), (iv) Draft Final Feasibility Study Report (3 meeting days) (v) three (3) Donor Conferences (2 meeting days each) (vi) Draft Bidding Documents (3 meeting days) and (vii) One (1) Meeting of Ministers in charge of Energy in the concerned countries (2 meeting Days).

The Consultant shall also make provision in his proposals to organize in collaboration with WAPP Secretariat Three (3) “Negotiation Meetings” (5 meeting days each) for TCN, CEB, GRIDCo and CI-ENERGIES to finalize the Commercial Agreement(s) and during which, the Consultant shall be present and participate as Resource Person.

The Consultant shall note that situations may arise where the Funding Agencies and other stakeholders make supplementary comments on the Final Reports. In these instances, the Consultant shall do all the necessary work and consultation to provide responses to the comments and incorporate the comments/responses into revised Final versions of the Report and redistribute.

In submitting amended Reports and to facilitate their review, the Consultant shall, as part of the submission, prepare a matrix that indicates among others, the comments that were made, the responses provided by the Consultant, and the page numbers of the amended report that contain the incorporated comments.

In a bid to mobilize funding for the implementation of the project, the Consultant shall prepare documentation (including Project Packaging and Financing Plan) and deliver appropriate presentations at a maximum of three (3) Donor Conferences aimed at presenting the Project for financing. The same shall be done for one (1) meeting of Ministers in charge of energy of the concerned countries. The dates for the Donor Conferences and meeting of Ministers in charge of energy shall be established by the WAPP Secretariat in coordination with the Funding Agencies and the relevant authorities. In addition, the Consultant in consultation with the WAPP Secretariat, shall provide all supplementary information and clarifications including Project Briefs requested during the meetings and thereafter.

6.1 Reports and Presentation

All reports, documentation, deliverable and presentations by the Consultant shall be prepared in English and French and shall be in form and format acceptable to the WAPP Secretariat and the Funding Agency. All electronic versions of reports shall be submitted on USB and shall contain editable and non-editable versions of the reports.

6.1.1 Inception Report

The Consultant shall present, in line with the above-indicated Schedule, an Inception Report that shall contain, inter alia, the work plan and methodology, work schedule, annotated comments of each report that shall be presented and delivered to the Client, WAPP Secretariat, TCN, CEB, GRIDCo and the respective Ministries in charge of energy in each country. The number of copies of the reports to be submitted shall be as follows:

- *Inception Report:*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

6.1.2 Monthly Reports

The report, which shall be in a form and format acceptable to the WAPP Secretariat and the Funding Agency, shall summarize the Consultant's activities during the period under review. The reports shall be issued in English and French by the 10th calendar day of *each month* for activities conducted in the preceding month. The number of copies of the reports to be submitted shall be as follows:

- *Monthly Report:*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CEB.*

- *Three (3) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
- *Three (3) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
- *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
- *Three (3) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
- *Three (3) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
- *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

6.1.3 Quarterly Reports

The Consultant shall provide Quarterly Reports. The reports shall describe the major tasks which have been undertaken in the performance of the studies, milestones towards the studies' completion, and percentage completion of the studies as at the end of the quarter. Financial data shall include photocopies of invoices from the Consultant as well as financial reports detailing expenditures of all funds and the daily rates of the Consultant, their hours worked and other direct costs. The reports shall be issued in English and French by the 10th calendar day after the end of the Quarter under review. The number of copies to the reports to be submitted shall be as follows:

- **Quarterly Reports:**
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

6.1.4 Project Master Schedule

Prepare and maintain a Schedule using software acceptable to the Client (such as MS Project) and effect monthly updating of the detail schedules demonstrating that the project

is progressing in accordance with the contractual obligations. The updated schedule shall be submitted as part of the Monthly Report.

6.1.5 Feasibility Study

6.1.5.1 Data Collection Report

The Consultant shall prepare a data report after the completion of the data collection and review task. The report shall include all technical and economic data on TCN, CEB, GRIDCo and CI-ENERGIES networks, including single line diagrams of the HV transmission network and substations, and maps showing the HV transmission network and substations. The report shall also indicate the assumptions and input data for carrying out the Feasibility study. In addition, the report shall also specify the design criteria to be used for the engineering of the Interconnection Project. Furthermore, the report shall reflect a description of the operation and maintenance regimes of TCN, CEB, GRIDCo and CI-ENERGIES as related to HV networks. The number of copies of the reports to be submitted shall be as follows:

- *Draft Report:*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*
- *Final Report:*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*

- *Five (5) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
- *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
- *Five (5) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
- *Five (5) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
- *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

6.1.5.2 Feasibility Study Report

All versions of the report (Draft, Final) shall contain an Executive Summary of not more than 10 pages. The Reports shall be delivered in a form (with cover page(s) and formatting) acceptable to the WAPP Secretariat, concerned utilities and Funding Agencies.

The number of copies of the reports to be submitted shall be as follows:

- *Preliminary Report:*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*
- *Draft Final Report:*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CEB.*

- *Five (5) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*
- *Final Report:*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Nigeria.*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to each of the Ministries in charge of energy in Togo and Benin*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to the Ministry in charge of energy in Ghana.*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to the Ministry in charge of energy in Côte d'Ivoire.*
 - *Fifteen (15) hard copies and one (1) electronic copy in English, and Fifteen (15) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

6.1.5.3 Prequalification and Functional Bidding Documents

The number of copies of the documents to be submitted shall be as follows:

- *Draft Final Bidding Documents:*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Five (5) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Five (5) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*

- *Five (5) hard copies and one (1) electronic copy in English, and Five (5) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*
- *Final Bidding Documents:*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to TCN*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Ten (10) hard copies and one (1) electronic copy in English to be delivered to GRIDCo*
 - *Ten (10) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Twenty (20) hard copies and one (1) electronic copy in English, and Twenty (20) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

The draft and final Bidding Documents shall be delivered in a form and formatting acceptable to the Client and the Funding Agency (ies).

6.1.5.4 Project Completion Report

The Consultant shall submit a draft Project Completion Report that summaries among others, the activities undertaken by the Consultant within the framework of the Study, Deliverables submitted, disbursements received, issues encountered, and lessons learnt to be taken into consideration in future studies.

The number of copies of the documents to be submitted shall be as follows:

- *Draft Project Completion Report:*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*
 - *Three (3) hard copies and one (1) electronic copy in English, and Three (3) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*
- *Final Project Completion Report:*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to TCN.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CEB.*
 - *Three (3) hard copies and one (1) electronic copy in English to be delivered to GRIDCo.*
 - *Three (3) hard copies and one (1) electronic copy in French to be delivered to CI-ENERGIES.*

- *Three (3) hard copies and one (1) electronic copy in English, and Three (3) hard copies and one (1) electronic copy in French, to be delivered to the WAPP Secretariat.*

In addition to the above highlighted, the Consultant shall note that the draft and final Project Completion Reports shall be delivered in a form, formatting and content acceptable to the Client and the Funding Agency (ies).

7.0 KEY PERSONNEL

The minimum required experience of the key staff is:

- | | | |
|-----|---|--|
| (a) | Title | : Project Manager |
| | Expected Level Of Effort (Person-Month) | : |
| | Years of Professional Experience | : 15 |
| | Participation in among others | Kick off meeting, Data collection exercise, data validation meeting, Network modelling validation, training at home office, Preliminary Report adoption, Provisional Report adoption, “Negotiations meetings” to finalise commercial Agreement, Donors Consultation Meetings, Meeting of Ministers in charge of Energy, draft Bidding Document adoption |
| | Specific Expertise | : Managed at least two (2) 225 kV and above transmission line projects that included Feasibility Studies, Preliminary Designs and Tender documents preparation. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required |
| | | |
| (b) | Title | : Transmission Planning Engineer |
| | Expected Level Of Effort (Person-Month) | : |
| | Years of Professional Experience | : 10 |
| | Participation in among others | Kick off meeting, Data collection exercise, data validation meeting, Network modelling validation, training at home office, Preliminary Report adoption, Provisional Report adoption, , |
| | Specific Expertise | : Involved in design and implementation of at least three (3) 225 kV and above transmission line projects including Feasibility Studies, Network simulations and analyses, Preliminary Designs and Tender documents preparation. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required. |

- (c) Title : **Transmission Line Design Engineer**
Expected Level Of Effort :
(Person-Month)
Years of Professional : 10
Experience
Participation in among others Kick off meeting, Data collection exercise, Network modelling validation, training at home office, Preliminary Report adoption, Donors Consultation Meetings, draft Bidding Document adoption
Specific Expertise : Involved in design and implementation of at least three (3) 225 kV and above transmission line projects including Feasibility Studies, Preliminary Designs and Tender documents preparation. Experience in rural electrification schemes involving shield-wire technology is also required. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
- (d) Title : **Substation Design Engineer**
Expected Level Of Effort :
(Person-Month)
Years of Professional : 10
Experience
Participation in among others Kick off meeting, Data collection exercise, Network modelling validation, training at home office, Preliminary Report adoption, Donors Consultation Meetings, draft Bidding Document adoption
Specific Expertise : Involved in design and implementation of at least three (3) 225 kV and above substation and switchgear projects including Feasibility Studies, Preliminary Designs and Tender documents preparation. Experience in rural electrification schemes involving shield-wire technology is also required. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
- (e) Title : **Protection and Control Engineer**
Expected Level Of Effort :
(Person-Month)
Years of Professional : 10
Experience
Participation in among others Kick off meeting, Data collection exercise, Network modelling validation, training at home office, Preliminary Report adoption,

- Specific Expertise : Involved in design and implementation of at least three (3) 225 kV and above substation and/or switchgear projects including Feasibility Studies, Preliminary Designs and Tender documents preparation. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
- (f) Title : **Economic and Financial Analyst**
Expected Level Of Effort (Person-Month) :
Years of Professional Experience : 10
Participation in among others Kick off meeting, Data collection exercise, data validation meeting, training at home office, Preliminary Report adoption, Provisional Report adoption, Donors Consultation Meetings, Meeting of Ministers in charge of Energy
- Specific Expertise : Involved in the economic, financial, risk, and sensitivity analyses of at least three (3) 225 kV and above transmission line projects. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
- (g) Title : **Communication and SCADA Engineer**
Expected Level Of Effort (Person-Month) :
Years of Professional Experience : 10
Participation in among others Kick off meeting, Data collection exercise, Network modelling validation, training at home office, Preliminary Report adoption
- Specific Expertise : Involved in the design and implementation of SCADA and communication facilities in at least three (3) 225 kV. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
- (g) Title : **Procurement Specialist**
Expected Level Of Effort (Person-Month) :
Years of Professional Experience : 10
Participation in among others Training at home office, Donors Consultation Meetings, Draft Bidding Document adoption

Specific Expertise	: Involved in the Tender document preparation of at least three (3) 225kV and above transmission line projects. The cost of the study should be valued at least US\$1,200,000, one of which should be in Africa. Working knowledge of English and French is required.
(h) Title	: Power Trading Expert
Expected Level Of Effort (Person-Month)	:
Years of Professional Experience:	10
Participation in among others	Kick off meeting, Data collection exercise, data validation meeting, training at home office, Preliminary Report adoption, Provisional Report adoption, “Negotiations meetings” to finalise commercial Agreement, Donors Consultation Meetings, Meeting of Ministers in charge of Energy.
Specific Expertise	: Involved in the development of Power Purchase Agreements and Transmission Service Agreements of at least three (3) transactions. Working knowledge of English and French is required.
(i) Title	: Legal Expert
Expected Level Of Effort (Person-Month)	:
Years of Professional Experience	: 15
Participation in among others	Kick off meeting, Data collection exercise, data validation meeting, training at home office, Preliminary Report adoption, Provisional Report adoption, “Negotiations meetings” to finalise commercial Agreement, Donors Consultation Meetings, Meeting of Ministers in charge of Energy.
Specific Expertise	: Involved in the drafting of Intergovernmental Agreements for at least two (2) regional projects. Working knowledge of English and French is required.

For the scope relating to the Electrification of communities/towns/villages, the dedicated team shall comprise:

Title	Line/Substation Distribution Engineer # 1
-------	--

- (j)
- | | | |
|---|---|---|
| Expected Level Of Effort (Person-Month) | : | |
| Years of Professional Experience | : | 10 |
| Participation in among others | : | Identification of provisional routes for medium voltage networks and substation locations, Recommendation on technology mode for achieving rural electrification, Proposal on least cost solution to achieve rural electrification. |
| Specific Expertise | : | Involved in the design of at least three (3) 33 kV and above transmission line projects, one of which should be in Africa. Working knowledge of English and French is an advantage. Demonstrated expertise in shield-wire electrification schemes shall also be an advantage. |
- (k)
- | | | |
|---|---|---|
| Title | : | Line/Substation Distribution Engineer # 2 |
| Expected Level Of Effort (Person-Month) | : | |
| Years of Professional Experience | : | 10 |
| Participation in among others | : | Identification of provisional routes for medium voltage networks and substation locations, Recommendation on technology mode for achieving rural electrification, Proposal on least cost solution to achieve rural electrification. |
| Specific Expertise | : | Involved in the design of at least three (3) 33 kV and above transmission line projects, one of which should be in Africa. Working knowledge of English and French is an advantage. Demonstrated expertise in shield-wire electrification schemes shall also be an advantage. |
- (l)
- | | | |
|---|---|---|
| Title | : | Line/Substation Distribution Engineer # 3 |
| Expected Level Of Effort (Person-Month) | : | |
| Years of Professional Experience | : | 10 |
| Participation in among others | : | Identification of provisional routes for medium voltage networks and substation locations, Recommendation on technology mode for achieving rural electrification, Proposal on least cost solution to achieve rural electrification. |
| Specific Expertise | : | Involved in the design of at least three (3) 33 kV and above transmission line projects, one of which should be in Africa. Working knowledge of English and French is an advantage. Demonstrated expertise in shield-wire electrification schemes shall also be an advantage. |
- Title
- Geodetic Engineer / Surveyor # 1**

- (m)
- | | | |
|---|---|---|
| Expected Level Of Effort (Person-Month) | : | |
| Years of Professional Experience | : | 10 |
| Participation in among others | | Identification of provisional routes for medium voltage networks and substation locations, preparation of all maps and drawings. |
| Specific Expertise | : | Surveyed or managed the survey of distribution line routes of at least three (3) 33 kV and above distribution line projects, one of which should be in Africa. Working knowledge of English and French is an advantage. |
- (n)
- | | | |
|---|---|---|
| Title | : | Geodetic Engineer / Surveyor # 2 |
| Expected Level Of Effort (Person-Month) | : | |
| Years of Professional Experience | : | 10 |
| Participation in among others | | Identification of provisional routes for medium voltage networks and substation locations, preparation of all maps and drawings. |
| Specific Expertise | : | Surveyed or managed the survey of distribution line routes of at least three (3) 33 kV and above distribution line projects, one of which should be in Africa. Working knowledge of English and French is an advantage. |

8.0 DATA/INFORMATION TO BE PROVIDED BY CLIENT

The WAPP Secretariat and concerned countries shall provide the following if available:

- Information on the existing electricity networks in each country.
- ECOWAS Master Plan for the Development of Regional Power Generation and Transmission Infrastructure 2019 - 2033
- WAPP Operations Manual
- WAPP Transmission Tariff Methodology

9.0 REPORTING REQUIREMENTS

The Consultant shall report to the WAPP Secretariat. However, each of the four utilities involved shall appoint a Project Manager who shall co-ordinate the activities of the Consultant in their respective countries.

All correspondences on the project from the Consultant addressed to any Party should be copied to the other Parties for their information.

10.0 CONDUCT OF WORK

Close coordination among the Consultant, WAPP, TCN, CEB, GRIDCo, CI-ENERGIES and the Study on the Line Route an Environmental and Social Impact Assessment Study shall be required.

The Consultant shall provide overall management of all aspects of the work / services. The Consultant shall nominate a Project Manager and a Deputy Project Manager (during all times of unavailability of the Project Manager) to liaise with the Client, WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES.

The Consultant shall work closely with the designated staff of the Client, WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES.

The Consultant shall participate in meetings with the Client, WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES.

The Consultant shall implement its internal quality control and assurance procedures during the execution of the Contract, and shall demonstrate that they are being applied.

11.0 PARTICIPATION OF WAPP, TCN, CEB, GRIDCo and CI-ENERGIES

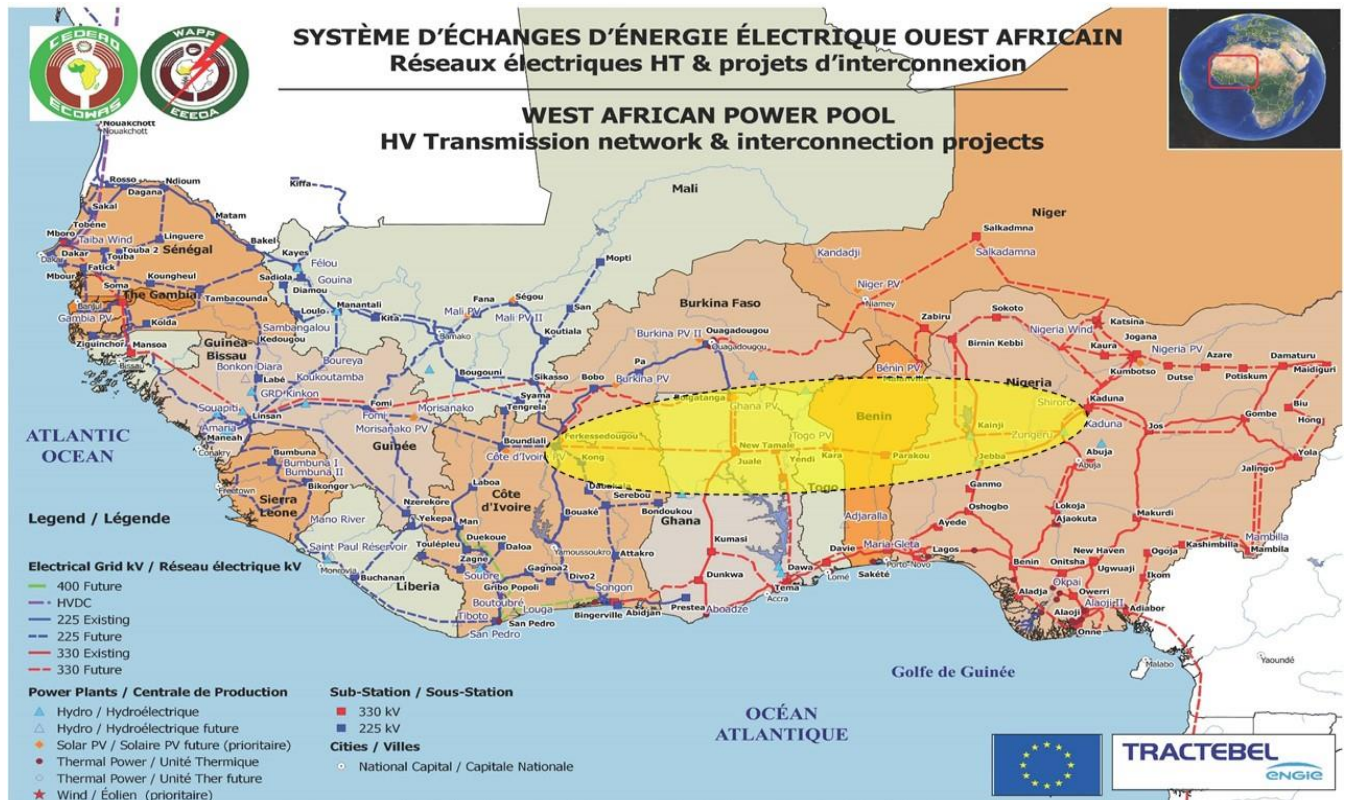
The Client, WAPP Secretariat, TCN, CEB, GRIDCo and CI-ENERGIES shall provide to the contracted Consultant if required;

- Office space as required, suitably furnished and with air conditioning, international telephone connections. All related consumption charges shall be the responsibility of the Consultant.
- Arrangements for meetings with representatives of WAPP, TCN, CEB, GRIDCo and CI-ENERGIES.

The Consultant shall make his own arrangements in coordination with the WAPP Secretariat for whatever services that the WAPP Secretariat cannot provide.

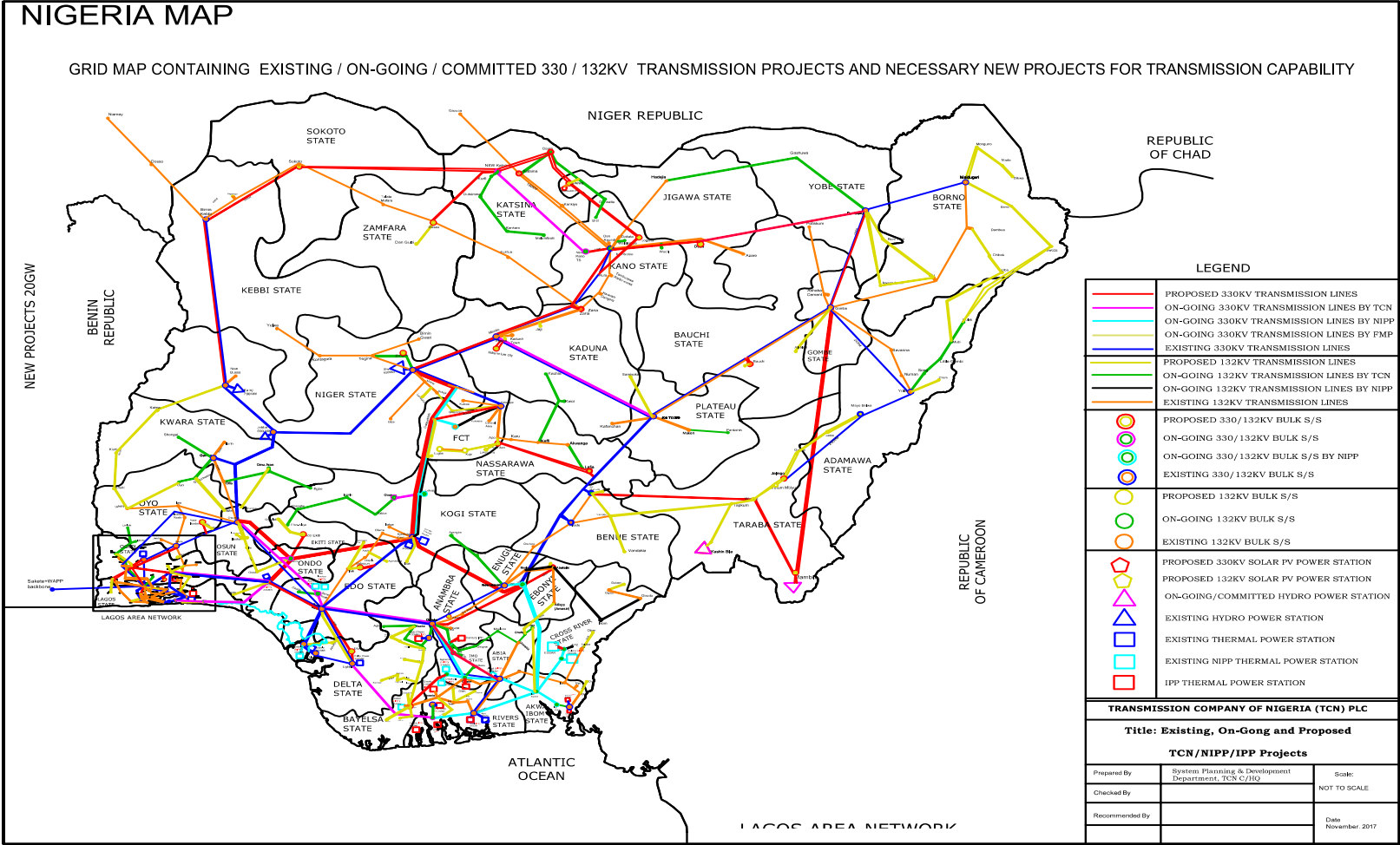
APPENDICES

APPENDIX 1: INDICATIVE MAP OF PROPOSED INTERCONNECTION (TO BE VALIDATED BY LINE ROUTE STUDY)

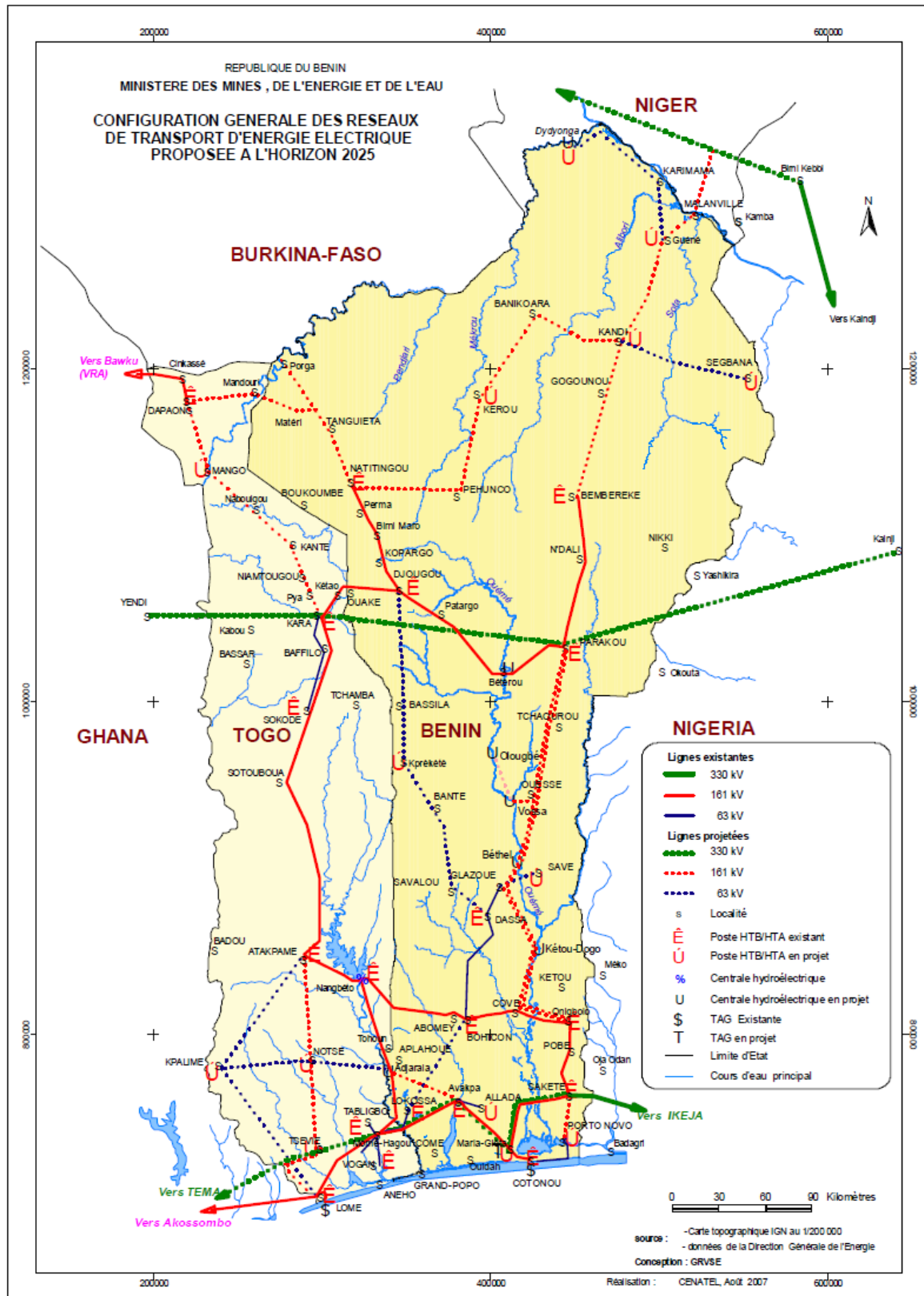


This map is only indicative. The actual route and distance of the line, together with the location of the substations, shall be based on the outcomes of the Line Route and ESIA Study.

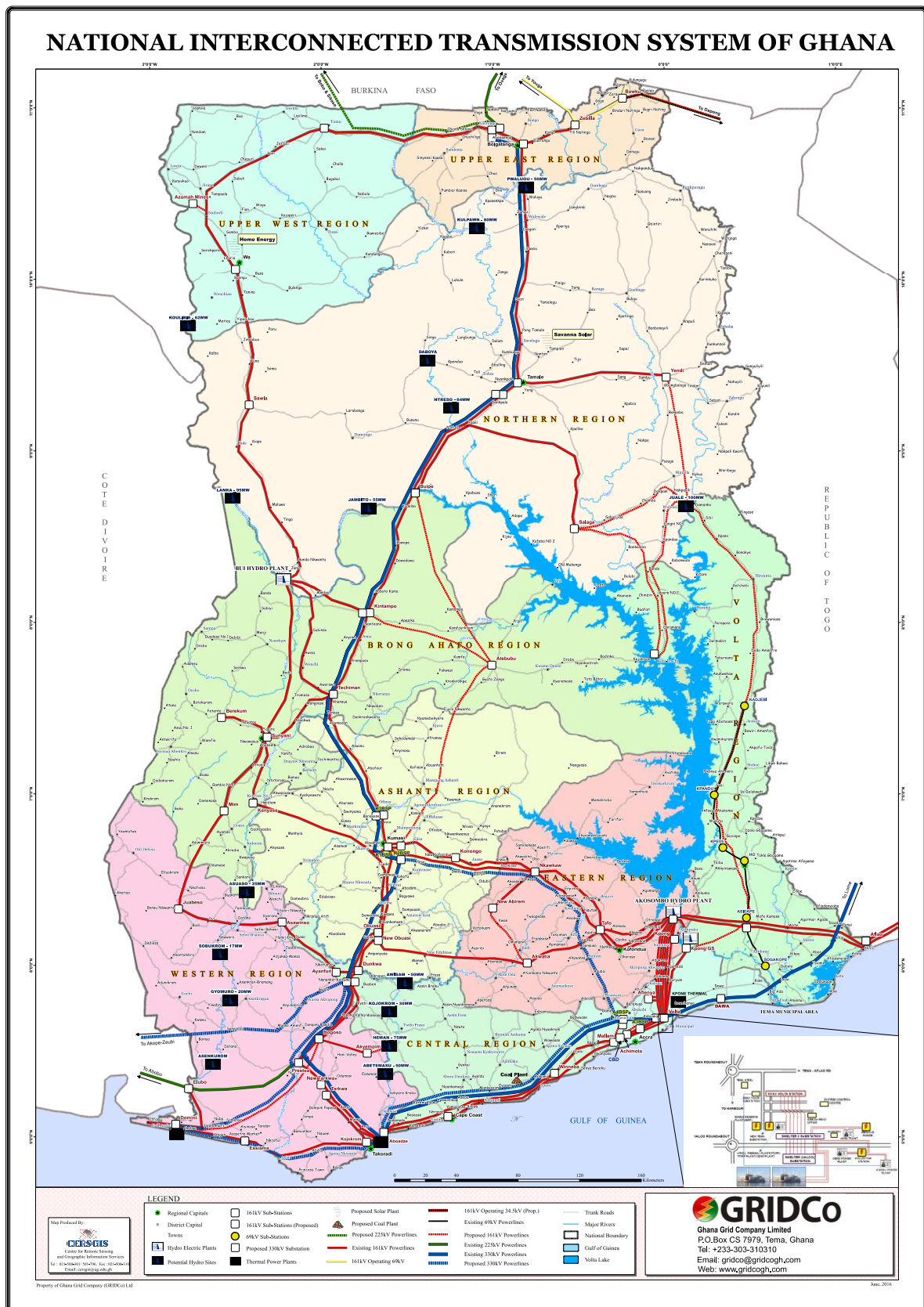
APPENDIX 2: INDICATIVE GRID MAP OF TCN



APPENDIX 3 : INDICATIVE GRID MAP OF CEB



APPENDIX 4 : INDICATIVE GRID MAP OF GRIDCo



APPENDIX 5 : INDICATIVE GRID MAP OF CI-ENERGIES

