Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 18-Jul-2019 | Report No: PIDC26540

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
Western Africa	P167569		ECOWAS - Battery Energy Storage Systems and Synchronization (BE3S) Project (P167569)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
AFRICA	Mar 16, 2020	Jul 29, 2020	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Investment Project Financing	ECOWAS,Ministry of Finance,Federal Republic of Nigeria,Republic Of Ghana,Republic of Cote d'Ivoire	ECOWAS Directorate for Energy, Ministry of Energy, Ministry of Energy	

Proposed Development Objective(s)

The PDO of the project is to increase ECOWAS power system capability to secure synchronous operation and enable renewable energy penetration.

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	259.80
Total Financing	259.80
of which IBRD/IDA	149.80
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Development Association (IDA)	149.80
IDA Credit	149.80

Non-World Bank Group Financing

Trust Funds	50.00
Clean Technology Fund	50.00
Commercial Financing	60.00
Unguaranteed Commercial Financing	60.00

Environmental and Social Risk Classification	Concept Review Decision
Moderate	Track II-The review did authorize the preparation to continue

B. Introduction and Context

Country Context

1. **Regional cooperation is critical to end extreme poverty and boost shared prosperity in the West African region.** For over 40 years, the Economic Community of West African States (ECOWAS) has united 15 countries with the stated goal of promoting economic cooperation and achieving 'collective self-sufficiency'. Its original members include Benin, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania (left in 2002), Niger, Nigeria, Senegal, Sierra Leone, The Gambia, Togo, and Burkina Faso (joined as Upper Volta). Cabo Verde later joined in 1977. The block of countries occupies a little over 5 million km2 and is highly heterogeneous—economically, culturally, and ecologically—presenting both opportunities and challenges to economic growth and development. ECOWAS is still promoting economic cooperation and regional integration as a tool for an accelerated development of the West African economy as per ECOWAS Vision 2020.[1]

2. **The effects of sustained macroeconomic growth are translating into improved economic governance.** The countries in the region are some of the poorest in Sub-Saharan Africa with gross domestic product (GDP) per capita of under US$1,000 on average and as low as US$363 in Niger. Thus, despite being home to around 33 percent of the Sub-Saharan African population, the region accounted for just 28 percent (US$1,606 billion) of GDP in 2015. There has been a positive economic trend over the past decade, driven mainly by growing domestic demand, increased foreign investment, favorable commodity prices, and improved economic governance. As a result, West Africa was one of the highest performing regions of the continent. Over the 1990–2015 target period, ECOWAS experienced a 29 percent reduction in overall poverty. Despite this economic performance, growth has not been inclusive. About 43 percent of West Africans live below the international poverty line combined with the persistence of inequality which did not change much between 1985 and 2015 (AfDB, 2018). A significant number of ECOWAS's member states face conditions of fragility, notably: The Gambia; Guinea-Bissau; Liberia; Mali; Sierra Leone; and Togo.

[1] The ECOWAS Vision 2020 is a resolution adopted by ECOWAS in June 2007 to significantly raise the standard of living of the people through conscious and inclusive programs.

3. **The benefits of integration have yet to be fully realized in the region due to a combination of structural, institutional, and physical factors.** ECOWAS incomes have narrowed with an estimated convergence rate of 11.4 percent. Nevertheless, integration and its associated opportunities for growth have remained constrained. Reasons for this include macroeconomic and fiscal challenges at the national level; limited national and regional capacities for planning, funding, and implementing regional programs; and the structural disparities between countries that create imbalances within the block, such as Nigeria's outsized economic weight. Experience from other regions shows that countries struggling to trade with their neighbors also typically find it harder to integrate with global value chains and indeed the region's integration into the global economy is low. One sign of this is that the region captures only 5 percent of Africa's total foreign direct investment.[2]

4. **Despite the fact that West Africa is well endowed in natural resources, less than 50 percent of its population has access to electricity.** This is well below the world average rate of 87 percent and leaves an access deficit of 188 million people unserved. This means that despite the region's large energy endowments, per capita consumption of electricity is among the lowest in the world with approximately 160 kWh consumed per capita annually. In the poorest countries, under 30 percent of the population has access to electricity (compared to 37 percent in Sub-Saharan Africa), with overall access rates below 12 in Guinea Bissau and Niger. The rural electrification rate averages around 18 percent, while six West African countries—Burkina Faso, Guinea, Guinea-Bissau, Liberia, Mauritania, and Niger—have less than 5 percent of their rural population electrified. Of the 188 million people with access to electricity services, about 67 percent reside in urban areas, but many suffer from unreliable electricity supply.

5. **Economies of the ECOWAS region cannot be competitive if electricity prices continue to be the highest in the world, electricity services continue to be unreliable, and the sector continues to be subject to price shocks and reliant on significant subsidies.** The cost of electricity in West Africa's power sector is among the highest in the world, driven by a high dependence on fossil fuel generation and rental generation stemming from poor planning. Average retail tariffs are US$ 0.25 per kilowatt-hour, which is more than twice the global average and the cost in advanced countries like the United States (US$0.12/kWh) and far higher than in many emerging economies like India (US$0.08/kWh). Many of the utilities import liquid fuels from international oil markets and are highly exposed to oil price and foreign exchange rate fluctuations. For remote landlocked countries such as Mali and Chad, these fuel costs include high transportation costs, the relatively low number of suppliers in the market and the high risks faced by these suppliers. In many cases, there is also dependence on 'emergency' rental generation (Mali, Guinea Bissau) which come at high cost due to their high opportunity cost (they are often in the form of containers that can rapidly be re-deployed to sites where customers are willing to pay their high prices).

6. **In addition to an expensive energy mix, many countries in the sub region have serious shortcomings in the operational efficiency of state-owned utilities, with significant commercial and technical losses.** Despite high tariffs, no country in the region has achieved full cost recovery and most (even those with high tariffs) are not recovering their operational expenditures.[3] The resulting quasi-fiscal deficits make utilities dependent on Government subsidies for capital investments at the very least, and often for survival. Finally, the service is erratic in many countries, averaging about 80 hours per month (system outages can reach 16h per day) – meaning it is some of the most unreliable electricity supply in the world. In response to this, the World Bank and other donors have in recent years adopted an investment strategy geared toward improving utility operational and financial performance and ensuring their long-term viability.

7. **In recognition that past efforts to achieve national self-sufficiency in electricity supply have been uneconomical, ECOWAS member countries established a specialized agency in 1999 (via Decision A/ Dec.5/12/99), namely the West**

[2] World Bank. 2017. *Unlocking Investment in Africa*.
[3] Kojima, M., and C. Trimble. 2017. *Making Power Affordable for Africa and Viable for the Utilities*. Washington, DC: World Bank.

African Power Pool (WAPP) to integrate the national power systems into a unified regional electricity market. This approach was based on the benefits of optimizing energy resources across the region, given different country endowments and load profiles. A regional mechanism creates the opportunity to both capitalize on large-scale generation plants designed to support multiple countries and trade power to maximize availability and minimize cost. The expectation is that, over the medium to long term, this mechanism will help to provide stable and reliable electricity supply at an affordable cost. The stark contrast between large energy surpluses in some countries and others who struggle with scarcity of cost-efficient sources of electricity suggests fertile ground for regional trade.

8. **The economic and technical benefits of efficient regional interconnected power systems, particularly power pools, have long been established.** The ECOWAS Infrastructure Master Plan approved in December 2018 confirms for the ECOWAS region the earlier findings of the World Bank Africa Infrastructure Country Diagnostic (AICD) and Programme for Infrastructure Development in Africa (PIDA) reports, which show that regional integration and power trading reduce the cost of production of electricity by up to 10 percent. The higher investment in infrastructure is offset by lower fuel costs, as production mix shifts toward lower-cost but more capital-intensive technologies (hydro and gas substituting for diesel; and the greater integration of intermittent renewable energy such as solar). The Bank estimates that the economic benefits of a fully integrated power market are of the order of US$5-8 billion per year for West Africa, with the potential to reduce the cost of electricity services by half in many countries in West Africa.

9. **The WAPP is underpinned by an infrastructure program comprising mutually reinforcing subprograms that will converge into a unified transmission system linking all West African countries by 2021.** In the past decade, WAPP member countries have successfully secured financing and set up the institutional structure to make major progress on five as follows: (i) The Coastal Transmission Backbone Subprogram P-094917 (Côte d'Ivoire, Ghana, Benin/Togo, and Nigeria); (ii) The Interzonal Transmission Hub Subprogram (Burkina Faso, Ghana, Côte d'Ivoire and Mali); (iii) The Gambia River Basin Development Organization P-146830 (OMVG) and the Guinea-Mali Interconnector P-166042 (The Gambia, Guinea, Guinea-Bissau, Mali, and Senegal); (iv) The North-Core Transmission Subprogram P-162933 (Nigeria, Niger, Burkina Faso, and northern Benin and Togo; and (v) The Côte d'Ivoire-Liberia-Sierra Leone-Guinea Power System p-113266. These programs are being implemented under the leadership of the WAPP, and with the support of several donors, including the World Bank, the African Development Bank (AfDB), and other multilateral and bilateral institutions.

10. **The WAPP has made significant progress and now finds itself at a critical juncture.** Phase 1 of the West Africa Regional Market was launched in June 2018 and focuses on bilateral trades. These have been emerging over a period of a decade as the completion of various interconnector projects allowed exchanges to take place between several country pairings and clusters. As of today, about 7 percent of the region's electricity is traded[4] across borders. Three countries, namely Niger, Togo and Benin, currently rely on imported electricity for most of their electricity consumption. Under phase 2 of the market, to be launched by the early 2020s, the WAPP is expected to create a day ahead wholesale power market at the regional level. This will be made possible in part because the primary interconnectors are expected to be completed by the early 2020s, and by the fact that the WAPP will have approximately 2,000 megawatt (MW) of excess capacity initially from Ghana and Côte d'Ivoire, excluding the potential development of new power generation in the region.[5] Ultimately, achieving the WAPP's objectives and ensuring its sustainability requires the expansion of electricity access to underwrite the power consumption and trade on which it is predicated.

11. **Developing the infrastructure for trade also includes building effective institutions and enforcing a sound regional regulatory and policy framework.** To synchronize the various transmission lines and to foster third-party access, the

[4] Côte d'Ivoire has signed export agreements with Mali, Burkina Faso, Benin, and Liberia. Nigeria exports electricity to Niger and Benin, also based in bilateral agreements; Mercados. 2016. *Power Pools in Africa*.

[5] The development of gas reserves in ECOWAS is currently under consideration in Côte d'Ivoire, Ghana, Nigeria, and Senegal.

right institutions, regulations and policies need to be put in place among member countries in a manner that is harmonized across the region. The ECOWAS Regional Electricity Regulatory Authority (ERERA) is the regulator of regional cross-border trade of electricity and the regional regulator of cross border electricity interconnections in West Africa. The Member States of ECOWAS in January 2008 established ERERA as a specialized institution of ECOWAS with main objective to ensure the regulation of interstate electricity exchanges and to give appropriate support to national regulatory bodies or entities of the Member States. The main missions and objectives of ERERA include (i) Regulation of cross-border electricity connections and trading among ECOWAS member states, (ii) Establishment of clear and transparent tariff setting methodology for regional power pooling, (iii) Facilitating the setting up of regulatory and economic environment for the development of the regional market, and (iv) Technical regulation of the regional power pooling and monitoring of regional market operations. ERERA has begun to issue important regulations such as the grid code and the market rules, although enforcement of these remains a challenge. From an institutional standpoint, ERERA's qualified staff and resources are quite limited, restricting its ability to respond the increasing demands of the power market.

12. **The WAPP Information and Coordination Center (ICC)** is an organ of the WAPP Secretariat and shall promote operational coordination between Transmission Owning/Operating Members through actual day-to-day information sharing/exchange between WAPP Operational Coordination Centers. The ICC is not yet fully-operational but will become effective when the ICC building, regional communication systems, and ancillary equipment are built (by 2020). The ICC's primary activities, when it becomes operational, are expected to be the collection, analysis, and publication of information providing an overview of the current situation in the WAPP. The ICC's activities will evolve with its transformation into an MSO as part of Phase 2 of the market development program, and its activities will then be: (i) coordination of exchange programs on interconnections; (ii) monitoring of power flows and the execution of appropriate measures relating to observed discrepancies; and (iii) resolution of imbalances and commercial settlements. Institutionally, the ICC currently lacks the qualified staff necessary to undertake the synchronous operation of the power pool. A full assessment of these issues for ERERA and ICC is provided in the 2018 World Bank Discussion Paper: *Assessment and Future Directions of the West Africa Power Pool*.

13. **The Clean Technology Fund (CTF) was established in 2008 to provide scaled-up financing to contribute to demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term greenhouse gas emissions savings**. Some of the investment programs financed by CTF are large-scale projects and regional projects and particularly where regional cooperation is required. The CTF aims at financing transformational actions by: (a) providing positive incentives for the demonstration of low carbon development and mitigation of greenhouse gas emissions through public and private sector investments; (b) promoting scaled-up deployment, diffusion and transfer of clean technologies by funding low carbon programs and projects that are embedded in national plans and strategies to accelerate their implementation; (c) promoting realization of environmental and social co-benefits thus demonstrating the potential for low-carbon technologies to contribute to sustainable development and the achievement of the Millennium Development Goals; (d) promoting international cooperation on climate change and supporting agreement on the future of the climate change regime; (e) utilizing skills and capabilities of the MDBs to raise and deliver new and additional resources, including official and concessional funding, at significant scale; and (f) providing experience and lessons in responding to the challenge of climate change through learning-by-doing. In preliminary discussions, the CTF has expressed interest in supporting the proposed project, although formal approval will only take place once a formal submission is made and it is approved by the CTF board.

14. **The proposed project has two objectives that support regional integration: firstly, it aims at fostering the**

regional energy market by promoting synchronization through financing activities of ancillary services[6], under the Phase 2 of the Market, which will improve the stability of the regional network, the integration of variable renewable energy, and reliability by increasing the energy reserve in the three countries. Secondly, the proposed project seeks to build the regional institutions under the aegis of ECOWAS that are required for a functional regional market, namely ERERA and the regional systems market operator (ICC). This results can be achieved efficiently manner taking the regional approach for the following reasons: (i) The system synchronization requires a holistic approach to optimize the investments; (ii) Economies of scale by joint-implementation at the ECOWAS level that would not be possible to achieve under a single-country approach; (iii) a regional program can ensure that all countries would adopt a harmonized and similar quality standard equipment, and (iv) The institutional support to key institutions ERERA and ICC can only be achieved under a regional approach.

Sectoral and Institutional Context

15. **Battery energy storage is required at the regional level to address some of the technical issues that are hindering the interconnections.** The technical issues arise from the imbalance in supply and demand between the countries, which requires synchronization, and the plans to develop grid-connected renewable energy projects, which will require more flexibility for system response. Battery energy storage systems (BESS) provides alternate means for grid support and ancillary services and represents a viable solution to solve the issues of system performances (frequency support, power quality) as well as scaling up renewable energy. BESS optimizes its output capacity in accordance with the demand, which makes it the best suitable option for frequency control.

16. **Battery Energy Storage is part of the solutions to transition towards a regional energy market**. According to the updated WAPP Master Plan, to develop a regional market it is expected that by 2029, 38 percent of the electricity produced throughout the West African region will come from renewable energy (RE) technologies, and the renewable energy mix will consist of 24 percent hydropower, 13 percent solar photovoltaic and 1 percent wind power. The injection of 38 percent RE without energy storage will create instability on the network. The WAPP Master Plan has also identified four additional transmission projects as priority in the short-term to ensure the stability of the system: (i) the 330 kV Ghana-Burkina-Mali interconnection, (ii) the 330 kV median backbone between Nigeria, Benin, Togo, Ghana and Côte d'Ivoire; (iii) the second circuit on the 225 kV CLSG interconnection project; and (iv) the 225 kV OMVS transmission line from Mali to Guinea.

17. **In addition to generation and transmission challenges, the interconnection of the previously disjointed subsystems requires hard and soft infrastructure to reach stability.** Part of the soft infrastructure is the dispatch centers, ancillary services for voltage and frequency control, and the development of the regional system market operator (ICC) and the strengthening of dispatching and market rules. Hence, the Battery Energy Storage Systems and Synchronization (BESSS) program will finance BESS applications for grid ancillary services to provide operating reserves for frequency and voltage regulation and variable renewable energy generation.

18. With more developed power systems, Nigeria, Ghana, and Cote d'Ivoire have especially important roles in a regional network. **Table 1** summarizes key sector indicators for the three countries. **Figure** 1 presents the peak load for each WAPP country, highlighting the pronounced peaks in Nigeria, Ghana, and Cote d'Ivoire.

Table 1. Key Sector Indicators

	Cote d'Ivoire	Ghana	Nigeria
Access to electricity (% of population)	82%[7]	84%	45%

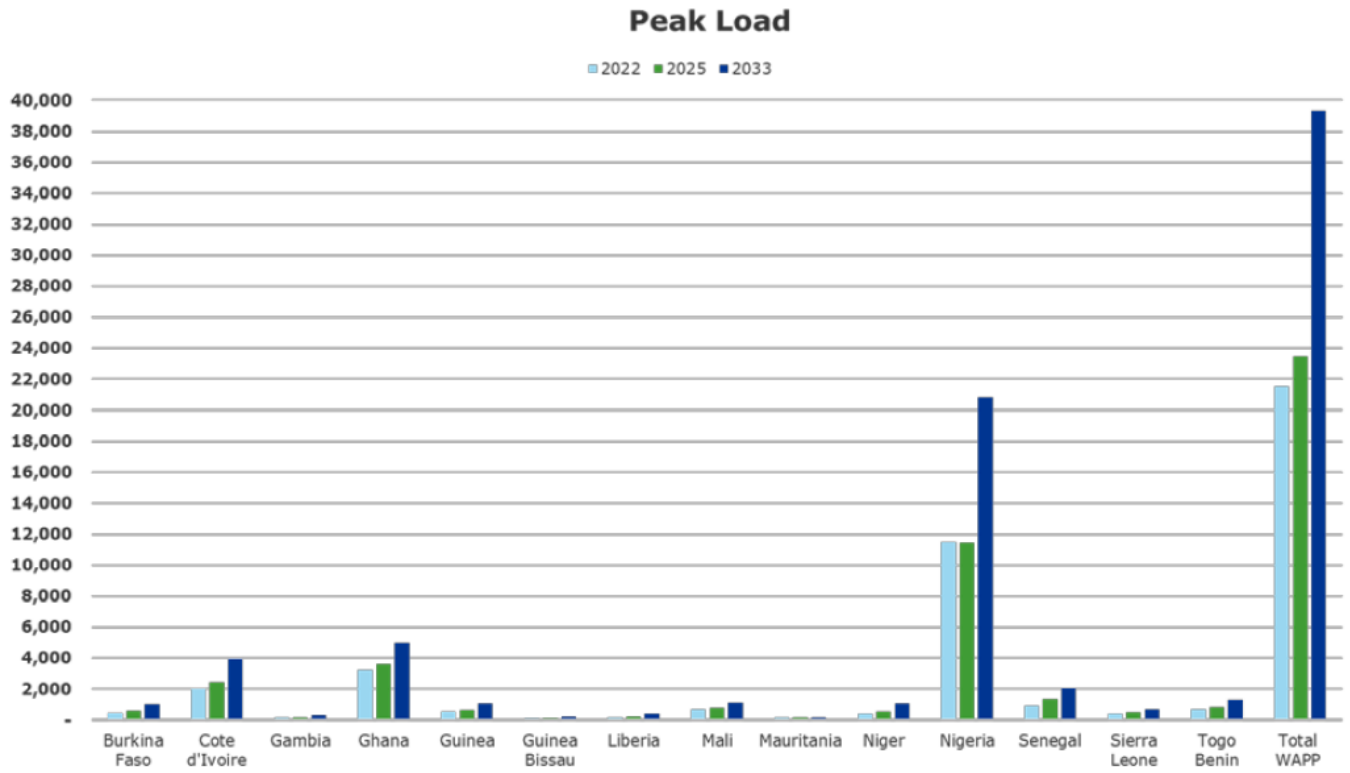
[6] [6] Ancillary services are the services necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations

7 In Cote d'Ivoire, access rate is the total population of electrified localities divided by the population of the country.

% urban	88%	85%	55%
% rural	31%	60%	35%
Number of customers	1,897,900[8]	4,200,000	5,400,000
System losses (%)	21.05%	29.4%	50%
Average electricity tariff (US$ per kWh)	0.12	0.15	0.094
Average cost of service (US$ per kWh)	0.2	0.23	0.2
Installed Capacity (MW)	2,172	4,741	7,500
Peak Demand (MW)	1,342	2,433	5,338

Sources: World Bank Internal Country Engagement Notes for Guinea and Mali, 2017.

Figure 1: peak load for WAPP countries



19. **The costs of reliable and synchronous network at national level remain prohibitive and create an opportunity for a regional, optimized approach.** The challenge of disjoint networks in the region is compounded by a lack of cogent regional financing plans. The assessment of Battery Storage applications in WAPP by DNV GL-Energy estimates, by 2022,a total BESS capacity of 1290 MWh with a cost estimate of US$ 387 million.. The technical and economical optimization of the study to select most important and critical locations for BESS technology is influenced by the Grid Developments and the amount of BESS. To reach a reliable WAPP network which could facilitate power trade, and based on Figured 1 above, the critical points of the network to receive BESS are Nigeria, Ghana and Cote d'Ivoire. Nigeria plays an important role within WAPP network with both Peak load and consumptions exceeding 50 percent of the interconnected system, follow by Ghana 15 percent and CI 10 percent. The selection of the three countries would benefit both national grids and regional

8 http://www.anare.ci/assets/files/pdf/rapport/ANARECI_RA2017.pdf

integrated networks. Considering WAPP's expected benefits of reliable network for regional power trade, there is a broad recognition at the regional level of the potential benefits in installing BESS at critical nodes of WAPP network.

Cote d'Ivoire

20. **Household access to electricity in Cote d'Ivoire, at about 38 percent, is relatively low given the country's per capita income, which is above US$1,400 per year.** The electricity penetration rate is around 54 percent (number of electrified villages out of the total number of villages in Cote d'Ivoire), indicating that a significant part of the population in electrified areas is unable to get a grid connection despite available supply. In response, the Government of Cote d'Ivoire has decided to provide a partial subsidy for the cost of connections, which is being supported by the Cote d'Ivoire Electricity Transmission and Access Project (P157055).

21. **Cote d'Ivoire has substantial potential hydroelectric capacity of over 1,900 MW, which can theoretically generate about 10,000 GWh/year**. Despite this significant untapped hydroelectric potential, only the 112 MW site of Gribo Popoli is under construction following the Soubre power plant on the Sassandra River (270 MW) commissioned in 2017. Other potentially attractive hydro sites are not yet at sufficiently advanced stages of technical preparation to be commissioned before 2020. Although the country has a number of thermal generation projects planned to secure additional power supply in the medium term, new thermal independent power projects are handicapped by a lack of gas supply. Local gas production (about 180 mmcfd) is no longer sufficient to meet power sector demand and is not expected to rise significantly due to a lack of new gas discoveries. Importing gas in liquefied form (LNG) has been studied and found to offer a credible supply option.

22. **Cote d'Ivoire, with excess generation supply, is the only significant regional electricity exporter at present**. In 2017, it exported 1,247 GWh to five clients: Énergie du Mali (EDM, 27 percent), Volta River Authority (VRA) in Ghana (19 percent), Communauté d'Énergie Benin for Benin-Togo (CEB, 6 percent), Société nationale d'Électricité du Burkina Faso (SONABEL, 47 percent), and Liberia Electricity Corporation in Liberia (LEC, 1 percent). Going forward, Cote d'Ivoire' is well positioned to be the main hub of electricity trading in the sub-region as the WAPP transmission line interconnections to Liberia and beyond are built. The 2014 electricity law has removed the monopoly of the system operator, CIE, thereby giving third parties access to its transmission network.

23. **The key electricity sector institutions and operators in Côte d'Ivoire include both public and private sector players**. The Société des Energies de Côte d'Ivoire (CI-ENERGIES) is a state-owned asset holding company responsible for managing public assets in the electricity sector as well as planning and contracting investments. The CIE is a private company that operates and maintains, on behalf of CI-ENERGIES, a vertically integrated business combining the national transmission and distribution networks and hydro generation plants under a 15-year renewable "affermage" (concession, without investment obligations) contract. CIE's affermage contract is set to expire in 2020, and the Government has begun an analysis of post-2020 options to improve the performance of the sector. Three IPPs provide gas-fired generation capacity which account for 60 percent of Côte d'Ivoire's power capacity and 80 percent of generation and rely on indigenous natural gas production from private producers, such as Foxtrot or CNR. The Autorité Nationale de Regulation du Secteur d'Electricité (ANARE) is the regulatory agency which has purely advisory functions. The Ministry of Oil, Energy, and Development of Renewable Energy sets policy and plays an overarching surveillance role of the sector. CI-ENERGIES is the contracting party with the gas suppliers and independent power producers.

Ghana

24. **Ghana has a high level of electricity access rate, at over 84 percent (2017) - second only to South Africa in sub-Saharan Africa.** Total installed generation capacity is 4,741MW (42 percent hydro, 57 percent thermal of which 26 percent

gas, 1 percent solar), while the peak load was 2,433 MW in 2018 with network losses of: transmission (4.4 percent) and distribution (25 percent - 12 percent technical and 13 percent commercial). The Government of Ghana has established energy sector targets for 2030 that include: (a) universal access to electricity, and (b) 10 percent of power supplied by renewable energy source. Ghana is also participating in the United Nations' Sustainable Energy for All (SE4ALL) initiative, which sets the universal access target to be met by 2030, and the Government aims to address the disparity between urban centers (where access is over 85 percent) and rural communities (60 percent) in both affordability and cost of grid connection due to income difference and geographical distances.

25. **The power sector is unbundled and has considerable private sector participation**. Ghana was one of the first countries in Sub-Saharan Africa to unbundle its power sector and attract private investment through independent power producers (IPPs), though all utilities are state owned. The Volta River Authority (VRA) manages hydropower assets and part of the thermal generation capacity. IPPs account for 15 percent of installed generation capacity. The transmission system is owned and operated by the Ghana Grid Company (GRIDCo), which was incorporated as a private limited liability company in 2006 following the separation of the transmission functions of the VRA from its other activities. The distribution of electricity is carried out by the Electricity Company of Ghana (ECG), with about 3.8 million customers in the south and center of the country, accounting for about 90 percent of retail power sales, and the Northern Electricity Distribution Company (NEDCo), a subsidiary of VRA, which services the remaining 10 percent. Ghana's high-voltage power grid is interconnected with neighboring countries (Cote d'Ivoire, Togo, Benin and, soon, Burkina Faso) and the country is a member of the WAPP.

26. **The power sector is in serious financial difficulties.** The sector's financial difficulties mainly stem from: (i) the high cost of fuel that is used by thermal power plants and gas supply shortages, which has stranded several power plants[9] ; (ii) high payments for installed capacity to EPPs and IPPs; (iii) high distribution losses; (iv) low revenue collections by ECG; and (v) non-payment by Government entities. Due to these factors, electricity sector revenues from tariff collection do not cover costs. The sector entities therefore have had to resort to expensive external debt to finance their operations. VRA has relied on short-term financing on domestic market to cover operating costs including fuel for many years. Thus, the sector has accumulated US$2.3 billion of net external debt as of March 2017. The cost of debt service has become a great burden on the financial situation of the sector. In addition, by 2021, it is expected that Ghana would have an excess of 2000 MW of installed capacity.

27. **In December 2015 tariffs were increased by 47 percent on average, but the increase did not resolve the sector's poor financial position.** Growth in electricity demand in 2016 has been lower than originally forecast, as consumers responded to the higher prices by rationalizing their consumption. There is some evidence indicating that industrial and commercial consumers have begun to use diesel generators, which on a marginal cost basis may work out to be cheaper than grid power at higher consumption levels. This indicates that consumer elasticity of demand for electricity may impact the Government's ability to close the revenue gap through further tariff increases, particularly in the absence of sustained improvement in the quality and reliability of supply. In March 2018, PURC announced electricity tariff reductions of 17 **percent** for residential and 30 percent for commercial consumers. The impact of the tariff reduction is yet to be seen.

Nigeria

28. **Access to electricity in Nigeria remains low in comparison to its level of economic development, with about 56 percent of the population (39 percent in rural areas) connected to the national power grid.** About 40 percent of those connected to the national power grid face multiple daily power cuts. Nigeria has the largest absolute access deficit in sub-

[9] The unreliable supply of gas from Nigeria and suspension of gas supply through the West African Gas Pipeline (WAGP) in 2016 due to nonpayment by Ghana, has led to stranded power plants without gas supply.

Saharan Africa and the second-largest in the world, after India.[10] Domestic generation is mostly hydro, followed by thermal gas , HFO, and solar. The hydro includes plants along the Niger River, which Ghana shares with eight countries in the sub-region. Nigeria's electricity sector is characterized by excess capacity but inadequate supply. Although the country's installed capacity is at 13.22 GW, available capacity is much lower and peak generation decreased from 5.1 GW on February 2, 2016, to 3.3 GW on February 2, 2017. The national 330kV high voltage (HV) transmission system is secure and in good condition, but difficulties in ensuring adequate supply are compounded by a weak sub-transmission system at the level of 132kV lines and transformation from 330 to 132 kV and 132 to 33 kV.

29. **Nigeria launched a far-reaching power sector reform program in 2001 that led to unbundling and privatization of generation and distribution companies in 2013.** Following the Electric Power Sector Reform Act of 2005, the sector was profoundly transformed, with the privatization in November 2013 of 11 DISCOs and five GENCOs (successors of the vertically integrated utility). Hydropower was concessioned to private operators while the TCN was maintained under public ownership. The Nigerian Bulk Electricity Trading Company (NBET) and the Market Operator (MO) were established.

30. **The institutional and market arrangements in the current Transitional Energy Market (TEM) are as follows**. The Nigerian Bulk Electricity Trading Company (NBET) a government-owned public company acts in an aggregator capacity as a bulk power trader. It has entered into power purchase agreements (PPAs) with GENCOs and resells power on to the DISCOs under Vesting Contracts that allocate a percentage of the capacity and energy output from one or more GENCOs to the relevant DISCO. The Nigerian Electricity Regulatory Authority (NERC) has the primary licensing function in the power sector and has the mandate to conduct retail tariff reviews that produces and updates the Multi Year Tariff Order (MYTO). The Transmission Company of Nigeria (TCN) is a monopoly transmission service provider that is fully government-owned and controlled. TCN incorporates the roles of System Operator and Market Operator under key regulations, including the Market Rules and Grid Rules, and enters into Connection Agreements with both GENCOs and DISCOs, which regulate their connection to the transmission network.

31. **The government has prepared a Power Sector Recover Program (PSRP) in March 2017 with the goal of putting the sector on a financially sustainable path.** The objectives of the PSRP are to restore the sector's financial viability by improving power supply reliability, take transitory support measures to meet growing demand, and strengthen sector governance and its institutional framework. Addressing the gap between the cost of supply and cost recovery is a cornerstone of the PSRP. The Recovery Program recognizes that until tariffs reach cost recovery, the government must make up the shortfall to ensure payment to the various service providers in the electricity supply value chain. The PSRP incorporates an action plan for addressing the institutional and governance challenges in the power sector, that include appointment of professional Boards to state agencies, declaring tariff policy for cost recovery, ensuring performance and accountability of the privatized distribution companies, and settling the debt arrears owed by government to the distribution companies as well as providing for payment of their bills going forward.

Relationship to CPF

32. **The proposed project is aligned with the most recent Country Partnership Framework (CPF, 2016-2019) for Cote d'Ivoire updated with the Performance and Learning Review (PLR, 2018-2021)**. This strategy aims at strengthening economic infrastructure to accelerate private-sector led economic growth. It would help strengthen the infrastructure and enable the crowding of private investors for development of future regional infrastructures.

33. **The proposed operation is fully aligned with the World Bank's Country Partnership Strategy (CPS) for Ghana**

[10] Energy Access Outlook 2017, International Energy Agency, 2017.

(2013-2017), as adjusted during the Performance Learning Review (PLR) which extended its period until 2018. The CPS focuses on three strategic pillars of support to the Government: (i) improved economic institutions; (ii) improved competitiveness and job creation; and (iii) protection of the poor and vulnerable. The proposed project supports the first pillar by focusing on improving the power market development to improve power supply to the country.

34. **The proposed project is aligned with the Nigeria FY2014-17 Country Partnership Strategy (CPS)**. The first strategic cluster of the CPS has a focus area: "increasing installed power generation and transmission capacity and improving the efficiency and governance of electricity delivery." The proposed project will contribute to this element of the focus area: "Improving market development."

35. **The proposed project is also aligned to the World Bank's Energy Strategy,** which is designed to help client countries secure affordable, reliable, and sustainable energy supply needed to meet the World Bank Group's twin goals of poverty reduction and shared prosperity.

C. Proposed Development Objective(s)

36. The PDO of the project is to increase ECOWAS power system capacity to secure synchronous operation and enable renewable energy integration and power trade.

Key Results (From PCN)

37. The expected PDO level results include:

- Additional reactive compensation capacity provided (MVaR)
- Additional firm capacity for frequency control provided (MWh)
- Improved Capacity building for ERERA and ICC to facilitate electricity trade
- Additional capacity of renewable energy enabled (MW)

D. Concept Description

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

The key activities proposed under the project include installation of batteries within the fence line of existing sub stations in Nigeria, Ghana and Cote d'Ivoire. The potential areas for the project are in Kaduna in Nigeria, Ferkessedougou/Bouaken in Cote d'Ivoire and Dunkwa/Kumasi in Ghana. The main environmental risks include the installation of batteries within current boundaries of electrical installations. The environmental risks anticipated are mainly: (i) fire and explosion risks during project operation, (ii) environmental hazards related to the disposal of used batteries containing hazardous waste, (iii) disposal and management of generic waste during the construction and

exploitation phase, (iv) occupational health and safety of workers, (v) nuisances related to air and noise emissions, and (vi) community health and safety.
However, majority of the impacts likely to be generated from the project activities are site-limited and can be mitigated with measures that are readily identifiable.

There is no civil works or expansion of substations expected which may lead to land acquisition that could adversely affect peoples assets, community properties and resources and pose other risks to communities. There will be limited number of contractors required for the installation of batteries with a small number of skilled workforce brought into the project areas. However since this is a regional project which spans three countries, contextual country related risks may arise during project implementation such as risks to contractor labor working in conflict areas/low security zones. Similarly the introduction of the skilled contractor workforce however small may heighten risks of GBV/sexual exploitation and the spread of communicable diseases to and from local communities. Currently the total number of substations and contractors/workers per country is not known and if installation work takes place in a number of substations simultaneously then the cumulative impacts of the project are heightened.

Further, ECOWAS lacks adequate experience in implementing the ESF in totality and are new to certain requirements like labor risks, GBV and stakeholder engagement.

Note To view the Environmental and Social Risks and Impacts, please refer to the Concept Stage ESRS Document**.**

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