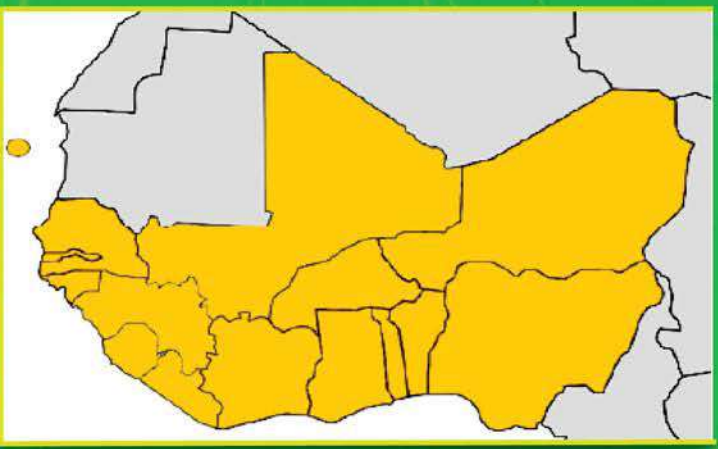
AFRICAN DEVELOPMENT BANK GROUP

COMPARATIVE ANALYSIS OF ELECTRICITY TARIFFS IN ECOWAS MEMBER COUNTRIES

An assessment of tariff frameworks, tariff levels and underlying drivers of tariffs across the electricity value chain (Generation, Transmission and Distribution) of the 15 Member Countries of ECOWAS



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ACRONYMS AND ABBREVIATIONS

AEB	Águas e Energia da Boa Vista
AfDB	African Development Bank
BGT	Bulk Generation Tariffs
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbine
CEB	Communauté Electrique du Bénin
CEET	Compagnie Energie Electrique du Togo
CIE	Compagnie Ivoirienne d'Électricité
CPI	Consumer Price Index
CSV	Composite Scale Variable
EAGB	Electricidade e Aguas da Guine-Bissau
ECG	Electricity Company of Ghana
ECOWAS	Economic Community of West African States
EDM	Énergie du Mali
EDSA	Electricity Distribution and Supply Authority
EPCL	Enclave Power Company
ERERA	ECOWAS Regional Electricity Regulatory Authority
EUR	Euro
EUT	End User Tariffs
GDP	Gross Domestic Product
GST	Goods and Services Tax
GWh	Giga-Watt Hour
HV	High-Voltage
IMF	International Monetary Fund
IPP	Independent Power Producer
Km	Kilometre
kWh	Kilo-Watt Hour
LCU	Local Currency Unit
LEC	Liberia Electricity Corporation
LV	Low-Voltage
MV	Medium-Voltage
MVA	Mega-Volt Ampere
MW / MWh	Mega-Watt / Mega-Watt hour
NAWEC	National Water and Electricity Company
NEDCO	Northern Electricity Distribution Company
NIGELEC	Société Nigérienne d'Electricité
O&M	Operation and Maintenance
OPEX	Operating Expenditures
PPI	Producer Price Index
PPP	Purchasing Power Parity
RAB	Regulatory Asset Base
RER	Renewable Energy Resources
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SBEE	Société Béninoise d'Energie Electrique
SEMAF	Société d'Exploitation de Manantali et Félou.
SOGEM	Société de Gestion de l'Energie de Manantali
SONABEL	Société Nationale d'électricité du Burkina Faso
TCN	Transmission Company of Nigeria
TOU	Time-Of-Use
TPWG	Tariff and Performance Working Group
TT	Transmission Tariff
USD	United States Dollars
VAT	Value Added Tax
VIU	Vertically Integrated Utility
VRA	Volta River Authority
WAPP	West African Power Pool
WACC	Weighted Average Cost of Capital
WBG	World Bank Group

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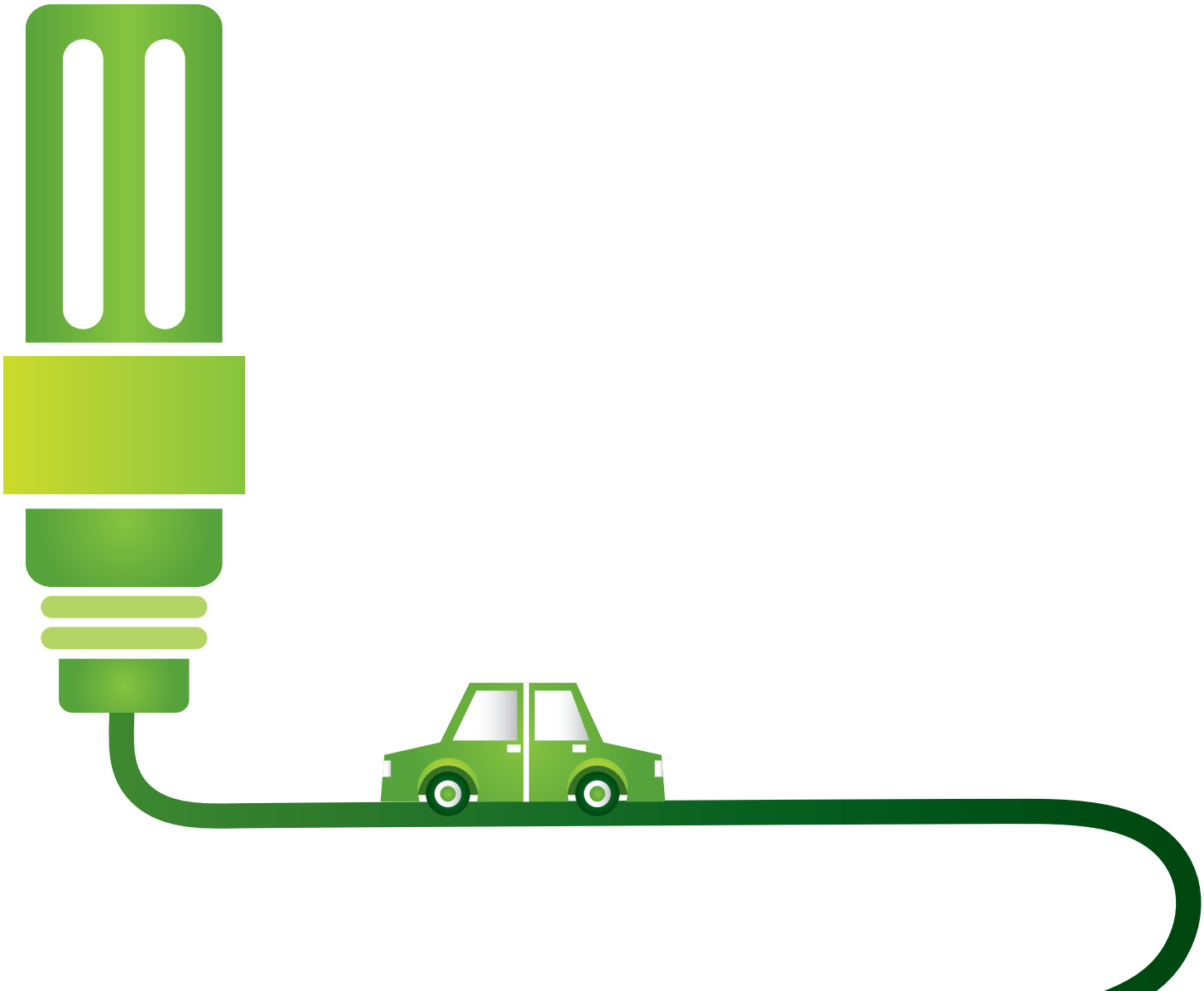
GLOSSARY

- **Availability Factor (%)**: (Number of hours that a power plant can produce electricity in the year) / (8760).
- **Average Plant Factor or Capacity Factor (%)**: (Generation in the year) / (Capacity * 8760).
- **Bilateral Contracts:** agreement between a buyer and seller in the regulated market to exchange electricity, rights to generating capacity, or a related product under mutually agreeable terms for a specified time-period.
- **Bulk Generation Tariff (USD/MWh)**: the tariff/price/charge at which electricity is procured from generators.
- **Capacity charge**: defined with a single value per kW or kVA of contracted or measured power.
- **Capital Expenditure (USD current replacement cost)**: expenditure to buy, maintain, or improve fixed assets, such as buildings, vehicles, equipment, or land.
- **Collection rate (%)**: collected electricity / total billed electricity.
- **Complete Unbundling**: independent entities in charge of generation, transmission and distribution.
- **Concessions**: contracts in which a private company enters into an agreement with the government to have the exclusive right to operate, maintain and carry out investment for a given number of years.
- **Consumer Price Index (CPI)**: index of the variation in prices paid by typical consumers for retail goods and other items.
- **Cost Plus / Rate of Return**: methodology to determine the Revenue Requirement by first identifying company total costs and investments and second establishing the allowed rate of return.
- **Cross-border electricity exports (GWh)**: electricity sold to other countries.
- **Cross-border electricity imports (GWh)**: electricity bought from other countries.
- **Cross-border electricity transit (GWh)**: electricity "passing-through" a country but not consumed there.
- **Cross-subsidy**: policies that reduce costs to particular types of customers or regions by increasing charges to other customers or regions.
- **Customer Average Interruption Duration Index - CAIDI**: (Total Customer Interruptions Duration) / (Total Number of Customers affected by the sustained interruptions).
- **Distribution Company - Disco**: regulated electric company that constructs and maintains the distribution wires connecting the transmission grid to the final customer.
- **Distribution Tariff**: the applicable authority regulates the Distribution sector and sets a distribution tariff based on the efficient costs for operating the network, including an appropriate return on network investment.
- **Electricity losses (% of injected electricity)**: difference between energy supplied at the input points and energy billed to customers in percentage terms for the year.
- **End-User Tariff (EUT):** the tariff paid by customers.
- **Energy charge (USD/kWh)**: tariff paid by customers per unit of electricity consumed[1].
- **Fixed charge (USD)**: corresponds to the monthly charge that is billed to the client regardless of the demand and consumption of the month.
- **Focal point**: Person in an ECOWAS member country responsible for data collation
- **GDP per capita (USD/person)**: Gross Domestic Product divided by population.
- **Gross Domestic Product (GDP)**: sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products.
- **Generation Company (Genco)**: entity that operates and maintains generating plants.
- **Generation**: process of converting primary energy (e.g. coal, gas, oil, stored water, wind and solar) into electricity.
- **Generator Capacity**: maximum output in megawatts (MW) that generating equipment can supply to system load, adjusted for ambient conditions.
- **Heat Rate**: amount of energy (BTU) used by a generator to produce one net kWh. Net generation accounts for all the electricity that the power plant consumes to operate the generator(s) and other equipment, such as fuel feeding systems, boiler water pumps, cooling equipment, and pollution control devices.
- **Hybrid:** combination of methodologies.
- **Incentive-Based Regulation**: form of regulation where the profit of a regulated company is determined by its actual performance relative to some pre-established standards of performance for service quality and cost effectiveness.

[1] Includes 1) Flat tariff (rate defined with a single value for all kWh of consumption regardless of the level of consumption). 2) Consumption block (tariff in which different prices are applied to the kWh according to consumption levels). 3) TOU (rate that applies different prices depending on the time of day in which the consumption is made).

- **Incomplete Unbundling**: includes 1) Accounting (separate accounts must be kept for the network activities and generation activities to prevent cross subsidization), 2) Functional (also called management unbundling, requires, in addition to keeping separate accounts, that the operational activities and management are separated for transmission and generation activities) and 3) Legal (requires that transmission and generation be put in separate legal entities).
- **Independent Power Producer (IPP)**: corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an electric utility.
- **Load**: amount of electricity being used or demanded at one time by a circuit or system.
- **Merger**: union of two or more commercial interests or corporations.
- **Non-Technical energy losses**: arise from several areas including theft, un-billed accounts, estimated customer accounts, errors due to the approximation of consumption by un-metered supplies and metering errors.
- **Open Access to Transmission Network**: possibility for any party selling or buying electricity to use the Transmission system without discrimination, subject to transparently formulated system security constraints, against payment of adequate fees.
- **Operating Expenses (OPEX)**: ongoing expenditure to run a product, business, or system, such as maintenance and repairs, supplies, insurance, salaries and wages, office expenses, property management, among other.
- **Price Cap**: determination of a fixed price by the regulator, and thus the profitability of the company is directly associated with its capacity to reduce its costs. Revenues are reviewed at predetermined intervals, typically every four to five years.
- **Regulatory Asset Base (RAB)**: assets of the regulated company included in the calculation of the Revenue Requirement. These should be those that are required to provide the electricity supply service in an efficient way or those resulting from reasonable investment decisions.
- **Renewable Energy Resources**: energy resources that are naturally replenishable, but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include: biomass, hydro, geothermal, solar and wind. In the future they could also include the use of ocean thermal, wave, and tidal action technologies.
- **Reserve Margin**: (Total Installed Capacity – System Peak Demand) / (System Peak Demand).
- **Revenue Cap**: determination of a fixed revenue by the regulator. Revenues are reviewed at predetermined intervals, typically every four to five years.
- **Revenue Requirement (RR)**: total amount of money to be collected by the regulated company from customers to pay all costs including a reasonable return on investment.
- **System Average Interruption Duration Index (SAIDI)**: (Total Customer Interruptions Duration Interrupted in hours; both planned and forced events) / (Average Number of Customers).
- **System Average Interruption Frequency Index (SAIFI)**: (Total Customer Interruptions; both planned and forced events) / (Average Number of Customers).
- **System Operation**: co-ordination of transportation services to ensure that the system is constantly in state of static electrical equilibrium (i.e. power supplied equals power demanded at each node of the network).
- **System Peak Demand**: highest demand (MW) observed in the year.
- **Tariff Cycle or Period**: length of time between rate reviews.
- **Tariff Level**: calculation of costs to be recovered by the regulated company.
- **Tariff Structure**: allocation of the costs of the system to each customer category/class.
- **Tariff**: regulated price and any additional regulated service conditions linked to it.
- **Technical energy losses**: electrical system losses which are caused by network impedance, current flows and auxiliary supplies.
- **Time-of-Use (TOU) rates**: pricing of electricity based on the estimated cost of electricity during a particular time block.
- **Total Operating Cost (Generation)**: sum of Fuel Cost, Variable OPEX and Fixed OPEX.
- **Transmission Company (Transco):** independent transmission company that is engaged solely in the bulk transmission of electricity, owns transmission assets and often manages system operation. It can be for-profit or not.
- **Transmission Tariff**: the applicable authority regulates the Transmission sector and sets a transmission tariff.
- **Vertically Integrated Utility**: unified ownership (i.e. no unbundling); network and generation activities owned and managed by the same company.

- **Weighted Average Cost of Capital (WACC)**: average rate of return a company expects to compensate all its different investors. The weights are the fraction of each financing source in the company's target capital structure (combination of equity and debt).
- **Wholesale Market**: system enabling purchases, through bids to buy; sales, through offers to sell; and short-term trades, generally in the form of financial or obligation swaps. Wholesale transactions (bids and offers) in electricity are typically cleared and settled by the market operator or a special-purpose independent entity charged exclusively with that function.



FOREWORD

The ECOWAS Regional Electricity Regulatory Authority (ERERA) was established on 18th January 2008 by the Authority of ECOWAS Heads of State and Government as a specialized institution of ECOWAS in charge of the regulation of cross-border trade of electricity between member states of ECOWAS.

The main missions assigned to ERERA include establishment of an enabling environment for the development of a regional electricity market and harmonization of institutions and structures of national electricity markets in the ECOWAS region.

For this purpose, ERERA's strategic plan places the setting up and operationalization of the regional common electricity market as a central element of its mission, while setting targets for 2020. One of the programmes of ERERA's strategic plan for 2016-2020 is the "harmonization of the policy and regulation of the ECOWAS electricity sector". The main objectives of this programme are to establish a regulatory and economic environment favourable to the development of the regional electricity market and make the structure of the national electricity markets compatible with the functioning of the regional electricity market. For the implementation of this programme, ERERA has received support from African Development Bank (AfDB) to conduct a fact-finding comparative study and analysis of electricity tariffs in ECOWAS member countries.

This study, while reviewing, the electricity market structure, the tariff policies, frameworks and methodologies of ECOWAS member countries, will update and sustain the methodology and the mechanism for collecting data on tariffs of the region, initiated by ERERA in 2014.

The study will further provide data and information to the investing public, the policy makers, regulators, and consumer in defining tariff and pricing policy, tariff design and structure and comparison of tariff rates across the sub region respectively.

ERERA will like to express its satisfaction for the support of AfDB and the cooperation of all stakeholders especially members of Tariff and Performance Working Group (TPWG) for the delivery of this detailed comparative tariff study report for countries in the ECOWAS region including country by country recommendations to guide in future tariff determination and reforms.

Professor D.S Bogler
Chairman
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- The ERERA Tariff and Pricing Working Group (TPWG) led by the Chairman Ahmed Ouedraogo for their continuous review of the draft report and methodological support, particularly their active participation in stakeholder workshops held in Accra and Abidjan during the project development.
- The Focal Points for all the 15 Member Countries of ECOWAS, who played crucial roles in providing and validating the data used in the study, often with important and valued support from other industry stakeholders in the countries, including the electricity utilities and Minsitries of Energy

We gratefully acknowledge the contributions of our translator and designer who worked to finalise the Report. It is worth noting that we have not exhausted the list of acknowledgements since many people contributed to the success of delivering this report, including the support staff at the ECOWAS Regional Electricity Regulatory Authority (ERERA) and the African Development Bank.

KEY TAKEAWAYS FROM THE STUDY

There is a significant variation in electricity tariffs across the ECOWAS region. A 5-6 times difference exists between the highest and lowest tariffs for comparable customers. The average end user tariffs (including taxes) for a standard Low Voltage consumer, ranges between 2.6 and 38.5 USDc/kWh. Similarly, the affordability of electricity varies across the region when measured on the scale of share of average income spent by households on electricity, with the share of average income spent on electricity by an average customer ranging from 2% to 6%. It is critical that the **member countries understand how these tariffs compare with costs, and how these affect customers, to identify appropriate levers for action.** In situations where tariffs are well below costs, the scope to move towards cost reflective tariffs should be investigated, and in other situations where both costs and tariffs are high, countries should first identify the reasons for the high tariff level and then consider ways to reduce the cost of electricity, both in generation and in network services.

Understanding the **relationship between costs and tariffs is also critical for developing subsidy policies**. Many countries apply subsidised blocks and provide VAT rebates to low volume consumers, but without a full knowledge of the revenue shortfalls created, and hence the requirements for cross-subsidies between tariff categories and/or the need for explicit governmental support.

The ECOWAS region has significant diversity in generation resources and costs, which creates significant potential benefits from cross-border electricity trade. In surplus countries extra revenue could be obtained through electricity export, and in deficit countries the demand gap could be met at the lowest available cost through electricity import. Ensuring open access to transmission networks for international flows is critical to achieve these gains. Electricity exports have reached about 8.5% of electricity produced within the ECOWAS region.

In most of the countries with vertically integrated entities, cost accounting processes do not separate the costs related to generation, transmission and distribution activities. **The introduction of Regulatory Accounting systems with requirements for reporting costs by activity and service** would enhance understanding of key costs drivers by utilities and regulators alike.

Several data gaps were reported for variables that are fundamental for regulatory price setting and monitoring, including capital and operating expenditure, losses targets, collection targets, and revenue breakdown by tariff category. The data gaps suggest that **focus needs to be placed on the role of information in the application of tariff regulation, specifically whether information used is sufficient and reliable to correctly implement regulatory models.** Difficulties in obtaining data for this study suggests that **it is critical to promote cultures where the collation and dissemination of quality information is prioritized**. ERERA can help facilitate this process through updates of this report, though ultimately the regulators should be encouraged to fully use their information gathering powers to obtain all necessary data for tariff setting purposes.

EXECUTIVE SUMMARY

The objective of this report is to analyse and compare the electricity tariffs of member countries within the ECOWAS region and provide the requisite information to policy makers, regulators and key stakeholders on tariff-related issues. This study is a fact-finding study, whose objective is to depict what is happening in each country, rather than to assess performance.

This Report compares tariffs through a review of five key areas: **Macroeconomic Overview**, **Tariff Frameworks** (TF), **Bulk Generation Tariffs** (BGT), **Transmission Tariffs** (TT) and **End-User Tariffs** (EUT).

Macroeconomic Overview

Based on GDP data across the region, there appears (as expected) a strong relationship between income levels and electricity access, with the highest access rates seen in the countries with the higher GDP per capita. There is also a close relationship between electricity access and population density. However, the countries that appear to outperform their peers on this indicator are also those with higher income per capita, indicating that income is a predominant explanatory factor.

Inflation differs significantly across the region. Higher inflation provides a greater onus on ensuring there are adjustment factors in the tariff to ensure costs and prices do not diverge unduly.

Tariff Frameworks

A wide range of industry structures exist from vertically integrated to fully structurally separated models. However, structures have evolved over the years to permit IPPs in all cases. While roughly half of the countries still have vertically integrated utilities, there is an ongoing trend towards structural separation. Ten countries report the presence of legislation that permits open access to transmission networks (Benin, Burkina Faso, Cabo Verde, Ghana, Liberia, Mali, Niger, Nigeria, Sierra Leone, Togo).

There is no clear trend in regulatory models and governance. The role of the regulator varies significantly, though in most countries, it is the regulator, rather than the Ministry who is tasked to set prices across the region. The countries identified with greatest involvement of the regulator are Nigeria, Liberia and Ghana. The greater regulatory involvement in Nigeria and Ghana is consistent with these countries having the highest degree of structural separation.

Cost based approaches to set prices are predominant. Cost Plus (Rate of Return) is used by at least eight countries (Benin, Cote d'Ivoire, Gambia, Guinea, Guinea Bissau, Liberia, Mali and Sierra Leone), Price Cap is the second most used methodology (Cabo Verde, Niger and Senegal), while Revenue Cap is used in Burkina Faso and Togo. Ghana and Nigeria have Hybrid methodologies. Furthermore, at least eight countries calculate a WACC to remunerate investments (Burkina Faso, Cabo Verde, Gambia, Ghana, Mali, Niger, Nigeria and Senegal).

Bulk Supply and Generation Tariff

Thermal power is the predominant source of generation. With the exception of Guinea, Liberia, Mali, and Sierra Leone, where hydro accounts for more than 50% of production, higher proportions of

electricity produced in most countries in the region comes from thermal sources. While three countries are net exporters of electricity (Côte d'Ivoire, Ghana and Nigeria), seven other countries are net importers of electricity (Benin, Burkina Faso, Gambia, Mali, Niger, Senegal and Togo). Apart from minor imports in Liberia, no other country reports electricity trade.

In Nigeria the regulator determines the generation costs paid by the distribution companies. Similarly, the regulator in Ghana approves the price at which electricity generators sell to distribution companies through the inclusion in the gazetted tariff schedule of a Bulk Generation Tariff, which is a weighted average price of projected electricity supply from all generation sources. In other countries a proxy Bulk Generation Tariff (BGT) has been estimated based on data on the annual generation cost of electricity and IPP purchases. The proxy BGT in the region varies significantly, ranging between 26 USD/MWh (Liberia) and 153 USD/MWh (Niger). Some of this large variation can be explained by the percentage of hydro production, other fuels used, generation heat rate and the costs of transporting fuels. However, greater understanding of invididual cost drivers is required.

Transmission Tariffs

Only four countries in ECOWAS have an explicit tariff for high voltage electricity transmission services: Benin, Ghana, Nigeria and Togo. In six other cases a proxy transmission tariff (TT) has been estimated, the sum of which shows that a typical TT is within the range of $9-18/MWh. Countries with an estimated TT above this range (Cabo Verde, Liberia) have small transmission networks and operate at relatively low voltages.

End-User Tariffs

The use of block tariffs for residential customers is common. However, there is wide variation in how blocks are applied, with the difference between the largest and smallest tariff block across the countries ranging between -13% (declining block tariff, seen in Côte d'Ivoire) and more than +200% (strong increasing block tariff, as seen in Guinea).

To compare End-User Tariffs (EUT) fifteen standard consumers with different assumptions of contracted demand and energy consumption were constructed. A standard consumer representing a single-phase domestic LV consumer is estimated to pay on average 2.6 USDc/kWh in Guinea, the lowest tariff in the region, and 38.5 USDc/kWh in Liberia, the highest including taxes. Notwithstanding the large difference between the extremes, the standard customer would pay between 18 and 22 USDc/kWh in more than half of the countries. A key determinant of the differences seen is the differences in the estimated BGT. Key exceptions are Gambia and Senegal, where the estimated BGT is above the average EUT and Liberia where the estimated BGT is well below the average EUT.

The most used cross-subsidy mechanism is Value Added Tax/General and Service Tax exemption, either for a specific consumption block, or for a category, and the use of a specific social tariff with a much lower tariff than applies to other small consumers.

In general LV domestic customer groups account for a lower proportional share of revenue than their share of energy consumption, while LV non-domestic and MV customers account for a proportionally higher revenue share. This indicates that revenue from industrial and commercial customers subsidises

prices to domestic customers, though greater understanding of the cost of service to different customer types is necessary to evaluate the extent of cross-subsidy.

A high-level estimate of affordability for domestic LV customers has been made by comparing the revenue obtained from an average domestic LV customer to average household income. The data shows on average that the share of income spent on electricity varies from 2% (Cabo Verde) to 5.1% (Côte d'Ivoire). The range is smaller than for tariffs, partly because average income is generally higher in countries with higher revenue per connection.

Challenges for service quality are reported in some countries. Of those reporting data, Nigeria and Niger have the highest frequency of interruptions (304 and 289 interruptions by customer in 2018 on average, respectively). Average duration of interruptions is longest in Nigeria and Guinea (742 and 238 hours of interruption by customer in 2018, respectively).

CHAPTER I.

INTRODUCTION

The ECOWAS Regional Electricity Regulatory Authority (ERERA) was established in 2008 to regulate cross-border electricity exchanges between ECOWAS Member States, while overseeing the implementation of the necessary conditions to ensure rationalization and reliability and contributing to setting up a regulatory and economic environment suitable for the development of the regional market.

ERERA received support from the African Development Bank (AfDB), the premier pan-African development institution, to produce this study. One of the missions of the AfDB is to achieve universal access to electricity in Africa by 2025, which is the aspirational goal of the Bank's New Deal on Energy for Africa. and one of the critical drivers to enable this goal is to strengthen energy policy, regulation and sector governance across Africa.

The objective of this report is to analyse and compare the electricity tariffs of member countries within the ECOWAS region and provide the requisite information to policy makers, regulators and key stakeholders on tariff-related issues.

The Comparative Analysis of electricity tariffs in ECOWAS member countries has been split into five main components: **Macroeconomic overview**, **Tariff Frameworks** (TF), **Bulk Generation Tariffs** (BGT), **Transmission Tariffs** (TT) and **End-User Tariffs** (EUT).

A. Macroeconomic overview

In this section, a brief overview of key macroeconomic variables in ECOWAS member countries is included to provide context to the study.

B. Tariff Frameworks

This section assesses key issues related to the tariff framework, including the role of the regulator, the structure of the electricity sector and tariff methodologies applied. Where possible, quantitative measures are used to allow high level comparisons to be made.

C. Bulk-Generation Tariffs

An assessment of the significance of generation tariffs is made drawing upon published tariffs, and where these are not available, data on the total cost of production to develop proxy values. Key underlying drivers of the BGT are then assessed.

D. Transmission Tariffs

Published transmission tariffs are reviewed in the member countries that have a specific tariff, with estimates made in other cases where data permits. Key underlying drivers of the TT are then assessed.

E. End-User Tariffs

EUT's are reviewed and compared through the development of standard consumer profiles. These standard consumers aim to facilitate a harmonised comparison across countries, despite differences in demand, consumption, tension level and customer behaviour in each country. The average tariff

(revenues collected from customers / quantity of electricity distributed) is also calculated. Key underlying drivers of the EUT are then assessed.

CHAPTER II.

DATA COLLECTION

The key steps of the data collection approach for the study were as follows:

i. A data collection template was developed and sent to the Focal Point (FP) of each country, that is, the person assigned by ERERA as responsible for data capture within its territory,
ii. The FP point was asked to fill out the questionnaire and provide documents containing relevant data to the Consultant,
iii. The Consultant compiled the relevant data into the questionnaire. Furthermore, desktop research and knowledge from the Consultant's network and projects complemented the questionnaires,
iv. The focal point was asked to validate and further compile missing datapoints;
v. The Consultant held web-conferences and/or phone calls for clarifications, support and help estimating data,
vi. The questionnaires were inspected and validated by the Consultant,
vii. Data was integrated into a database.

The database was structured in MS Excel with the same worksheets as the questionnaires (See Annex II). The difference resides in the fact that the database summarizes the fifteen questionnaires into a single file.

CHAPTER III. COMPARATIVE ANALYSIS

A. Macroeconomic overview

A brief overview of key macroeconomic variables in ECOWAS member countries is included to provide context for the study.

The figure below presents GDP per capita (PPP international dollars) and access to electricity (% of population with service) in each country. Both variables vary significantly between countries. GDP per capita at PPP ranges between USD 1,217 (Niger) and USD 6,913 (Cabo Verde), with access varying between 13.0% (Niger) and 92.9% (Cabo Verde).

Table 1 – GDP per capita and access to electricity (2017 values unless otherwise stated)

	GDP per capita (current PPP int.USD)	Access to electricity (% of population)
Benin	2286.99	43.1%
Burkina Faso	1866.62	25.5%
Cabo Verde	6912.64	92.9%
Côte d'Ivoire	3902.41	65.6%
The Gambia	2642.2	56.2%
Ghana	6099.3	79.0%
Guinea	2188.51	35.4%
Guinea-Bissau	1864.94	26.0%
Liberia	1404.53	21.5%
Mali*	2383.96	44.0%
Niger*	1216.76	13.0%
Nigeria	5941.27	54.4%
Senegal	3459.4	61.7%
Sierra Leone	1561.09	23.4%
Togo	1670.69	48.0%

*As of 2018

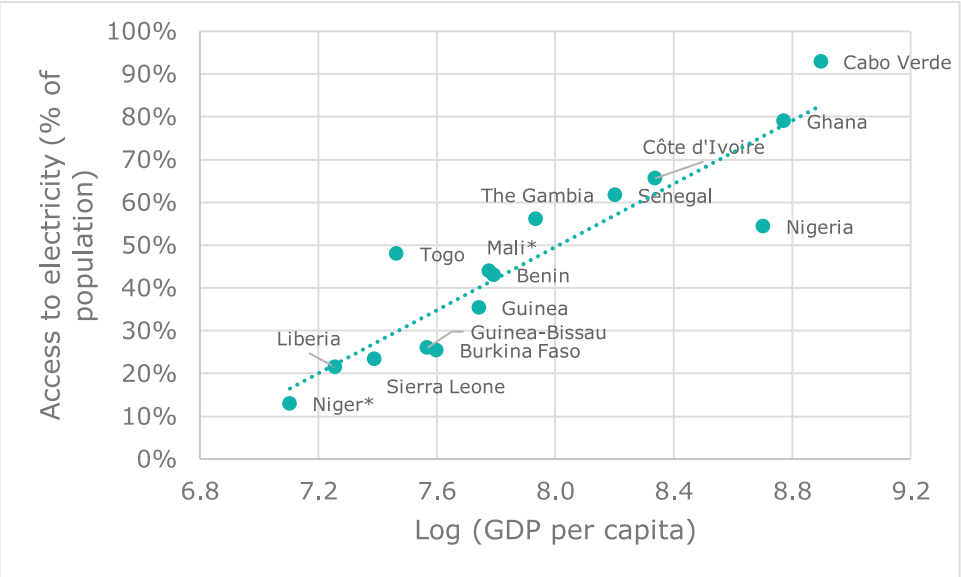
Source: IMF, WBG and local sources

To assess the relationship between income and access to electricity, a simple linear regression model was developed, assessing the relationship between access (y) and the natural logarithm of income (x). The following functional form was obtained:

$$y = -2.4579 + 0.3692\, Ln(x)$$

The results are illustrated in the figure below. The figure shows access (vertical axis) as a function of logarithm of income level (horizontal axis). Countries in quadrant I, i.e. those with log of GDP per capita higher than 8 USD and access to electricity higher than 50% are Cabo Verde, Ghana, Nigeria, Cote d'Ivoire and Senegal. All other countries are in quadrant III, showing log of income between 6.8 and 9.2 USD and access to electricity lower than 50%, except for Gambia, which is in quadrant II.

Figure 1 – GDP per capita (PPP int. dollars) and Access to electricity (% of population)

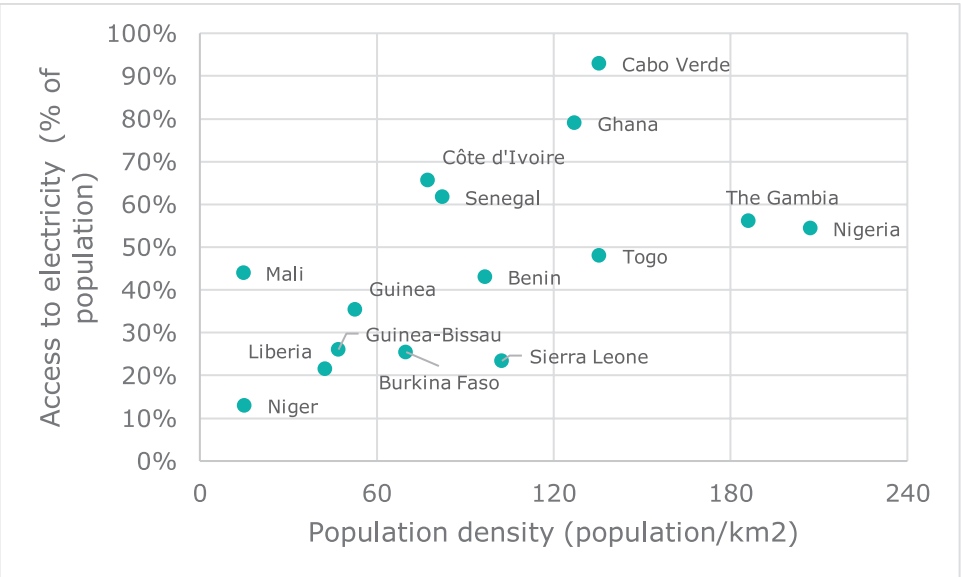


Source : Author's own calculation

The functional form shows what intuition suggests: a positive relationship between income level and electrification. The explanatory power of the model measured by the R_2 coefficient is approximately 84%. In other words, 84% of the evolution of access is explained by income level in this relatively small sample.

Another anticipated facilitating factor for electrification is the population density, where the higher the population density, the greater the potential economies of scale in the development of network infrastructure and ease by which the utility can connect new customers. The following graph illustrates this relationship.

Figure 2 – Population density (population/km2) and Access to electricity (% of population)

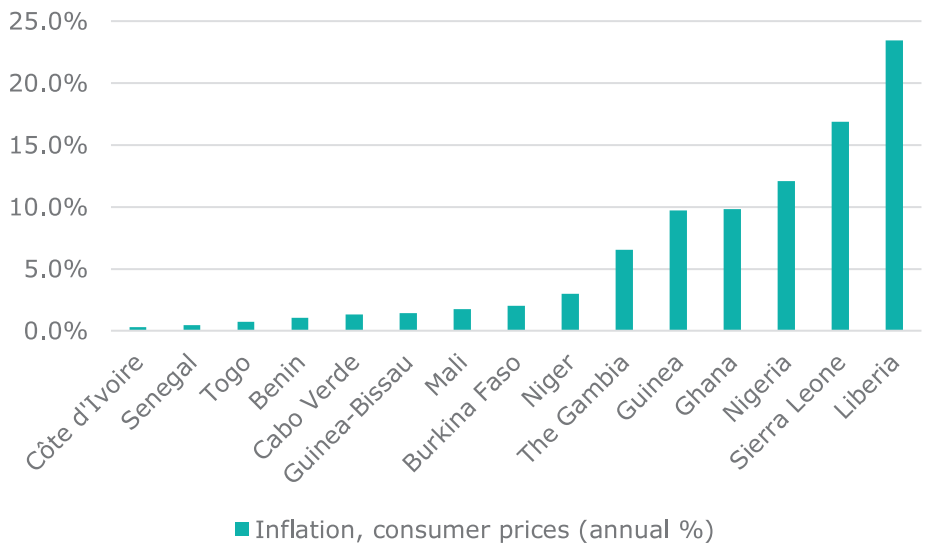


Source: WBG, IMF and data collected by the authors

The above relationship is not as strong as for income. However, the graph allows for simple identifaction of countries that appear to be out-performing peers by population density (e.g., Cabo Verde, Ghana, Senegal, Côte d'Ivoire). As the earlier graph shows these four countries in the higher tranche of income per capita, it generally supports the predominant facilitating role for income in explaining trends in electricity access.

Inflation is an important indicator for comparative purposes since the higher the inflation the greater the risk of tariffs and costs becoming misaligned, and the greater importance for tariff adjustment processes to be in place. In 2018 the annual percent change in prices (inflation) ranged between 0.3% in Cote d'Ivoire and 23.4% in Liberia. There are two other countries with double digit inflation rates in 2018: Nigeria (12.1%) and Sierra Leone (16.9%).

Figure 3 – Inflation, end of period consumer prices (percent change) (values as of 2018 unless otherwise stated)

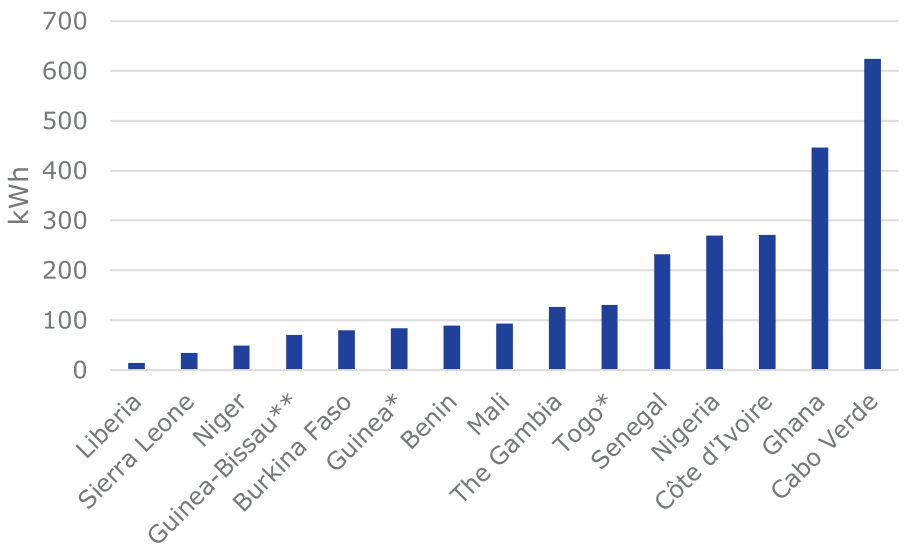


Source: IMF

The data suggests that regulatory protection against inflation is most critical for The Gambia, Guinea, Ghana, Nigeria, Sierra Leone and Liberia.

The consumption of electricity per capita per year was calculated in each country, as portrayed below. Ghana and Cabo Verde are the countries with the highest per capita electricity consumption, reaching 446 kWh and 624 kWh in 2018 respectively.

Figure 4 - Electricity consumption per capita per year (kWh) (values as of 2018 unless otherwise stated)



*As of 2017, **As of 2015

Source: Data collected by the authors

Further details on macroeconomic parameters are set out in Annex I.

Summary findings – macroeconomic overview

- *There is a strong relationship between income levels and access to electricity*
- *Inflation differs significantly across the region –higher inflation provides a greater onus on ensuring there are adjustment factors in the tariff to ensure costs and prices do not diverge unduly*

B. Tariff Frameworks (TF)

This section assesses key tariff framework issues, including the role of the regulator, the structure of the electricity sector and tariff methodologies applied.

B.1 Areas of responsibility of the regulatory body

Data was collected to assess the breadth of regulatory involvement in the member countries but without delving into the quality of this intervention. Therefore, this assessment aims to provide a high-level overview of the scope of the regulator's activities but does not measure governance, substance and outcome, like AfDB's Electricity Regulatory Index (ERI) for Africa.

First, to evaluate the role of the regulator in each country in relation to tariff related issues, information was gathered on who is legally responsible for the decision-making process of the following key topics:[2]

- Tariff level,
- Tariff structure,
- Quality of service,
- Consumer complaints,
- Sector investment plans:
  - Generation,
  - Transmission,
  - Distribution,
- Wholesale market structure,
- Anti-competitive behavior,
- Merger/acquisition reviews,
- Technical and safety standards,
- Concessions,
- Licencing,
- Approval/validation of bilateral contracts for selling or buying electricity (in the regulated market),
- Approval/validation of contracts for connection and use of transmission facilities,

Second, to quantitatively assess the responses, the following scale was considered for each topic:

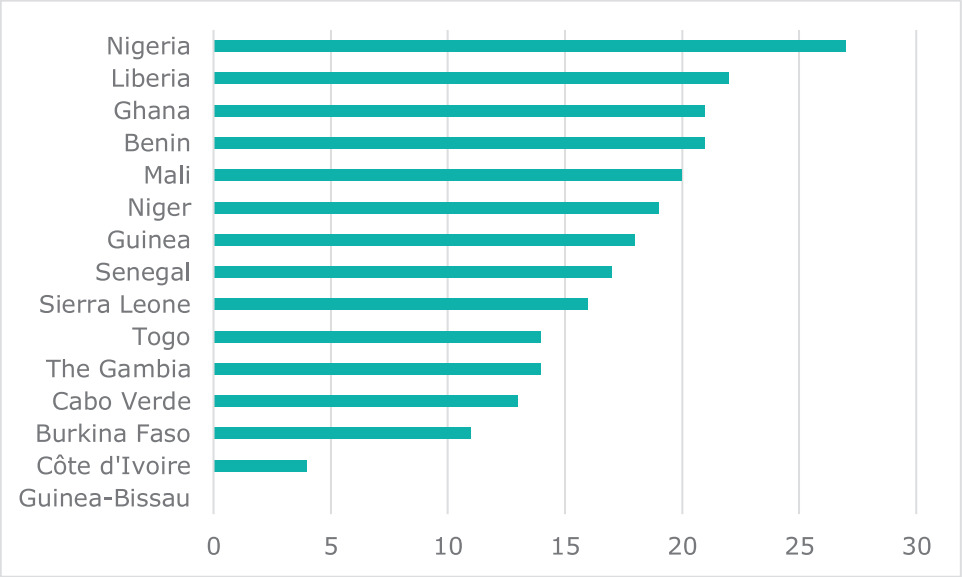
- 0: The regulator is not responsible for the topic,
- 1: Shared responsibility between the regulator and the Ministry in charge of energy, and/or the planning agency, operator, utility, or other,
- 2: The regulator is fully responsible for the topic.

Finally, the individual scores were added up, as portrayed in the figure below.

2 In some cases, the organization responsible for carrying out some topics differs from that stipulated in the law. In the case of conflict, the legal requirements take precedent.

Based on this classification, the distribution presented below arises, in which in Nigeria, Liberia and Ghana, the regulators participate more and with less shared responsibility in key areas such as tariff level, tariff structure, quality of service, and consumer complaints.

Figure 5 – Scope of involvement of the regulatory body



Source: Data collected by the authors

Guinea Bissau is portrayed with no scope of involvement given that there is no regulator. In addition, the regulator in Guinea was only recently established and thus the rating is based on expectations from the legislation rather than practical observations.

Various forms of shared responsibility was identified[3], with the most common being with the Ministry responsible for energy[4] and the utility[5].

3 See "1s" in the table below

4 Reported by Cabo Verde, Ghana, Liberia, Niger, Sierra Leone and Togo.

5 Reported by Benin, Côte d'Ivoire, Gambia and Burkina Faso. Moreover, Mali and Senegal reported examples of shared responsibilities with the Ministry and the Utility.

Table 2 – Responsibility of the regulatory body as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana*	Guinea	Guinea-Bissau**	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Tariff level	2	0	2	1	2	2	1	N/A	2	2	2	2	1	2	1
Tariff structure	2	2	2	1	2	2	1	N/A	2	2	2	2	2	2	1
Quality of service	2	2	2	0	2	2	2	N/A	1	1	1	2	1	2	1
Consumer complaints	1	1	1	1	2	2	2	N/A	1	1	2	2	2	1	2
Sector investment plans								N/A							
- Generation	1	1	1	0	0	0	1	N/A	1	1	1	2	1	0	1
- Transmission	1	1	1	0	0	0	1	N/A	1	1	1	2	1	0	0
- Distribution	1	1	1	0	0	0	1	N/A	1	1	1	2	1	0	1
Wholesale market structure	1	0	1	0	2	2	1	N/A	1	2	0	1	1	1	0
Anti-competitive behaviour	2	0	2	1	2	2	1	N/A	2	2	2	2	1	1	2
Merger/acquisition reviews	0	0	0	0	0	2	2	N/A	2	2	0	2	1	1	0
Technical and safety standards	0	2	0	0	0	2	1	N/A	2	0	1	2	1	1	1
Concessions	2	0	0	0	0	0	1	N/A	1	1	1	0	1	1	1
Licencing	2	0	0	0	2	2	1	N/A	2	0	1	2	1	2	1
Approval/validation of bilateral contracts for selling or buying electricity (in the regulated market)	2	1	0	0	0	2	1	N/A	2	2	2	2	1	1	2
Approval/validation of contracts for connection and use of transmission facilities	2	0	0	0	0	1	1	N/A	1	2	2	2	1	1	0
Total	**21**	**11**	**13**	**4**	**14**	**21**	**18**	**N/A**	**22**	**20**	**19**	**27**	**17**	**16**	**14**

Note: 0: Regulator is not responsible for the topic; 1: Shared responsibility; 2: Regulator is fully responsible for the topic.

*Includes both PURC and EC

**There is no regulator in Guinea Bissau

Source: Data collected by the authors

B.2 Market Structure

As defined by the Body of Knowledge on Infrastructure Regulation[6], restructuring is the separation of functions in a vertically integrated firm, leading to the unbundling of services.

To measure the stage of restructuring reform in each country, the model classification of Foster et al. 2017 (WBG working paper) was adapted to the reality of sub-Saharan Africa, as follows:

- 1) **Vertically Integrated Utility (VIU) without Independent Power Producers (IPPs)**
- 2) **IPPs + VIU**
- 3) **IPPs + VIU + isolated distribution**[7]
- 4) **IPPs + Generation (G) and Transmission (T) + Distribution (D)**
- 5) **IPPs + G + T + D**

The following distribution arises:

Figure 6 – Market structure

1. VIU (no IPPs)	2. IPPs + VIU	3. IPPs + VIU+ Isolated distribution	4. IPPs + G and T + D	5. IPPs + G + T + D
• None	• Burkina Faso • Cabo Verde • Gambia • Guinea • Guinea Bissau	• Cote d'Ivoire • Liberia • Mali • Niger • Senegal	• Benin • Sierra Leone • Togo	• Ghana • Nigeria

Source: Data collected by the authors

As portrayed, Ghana and Nigeria are the only countries with full unbundling (level 5 of the classification above). In Benin, Sierra Leone and Togo, the Distribution sector is largely separated from Generation and Transmission (level 4 above), whereas in the rest of the countries the VIU is mostly in charge of Generation, Transmission and Distribution. For the latter, four countries have the following types of incomplete unbundling[8]:

- Cote d'Ivoire and Niger: Accounting unbundling,
- Senegal: Functional unbundling, and
- Cabo Verde: Legal unbundling.

6 http://regulationbodyofknowledge.org/

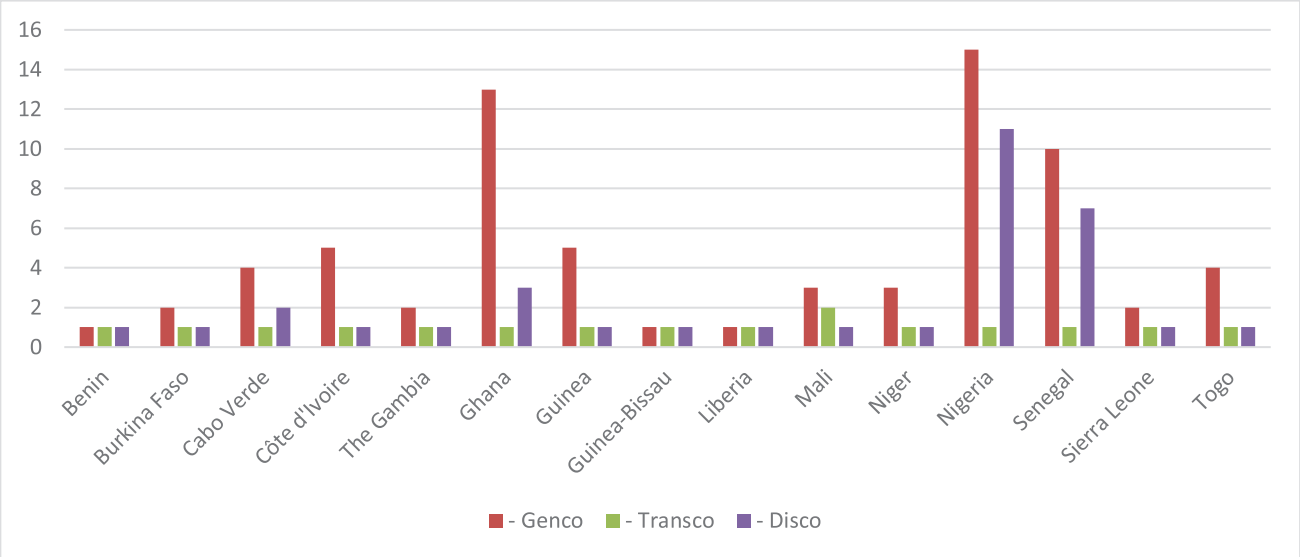
7 Isolated distribution is refered to distribution networks in isolated areas, which may or may not be operated by the utility

8 Accounting unbundling: separate accounts kept for transmission and generation (to prevent cross subsidization); Functional unbundling: requires, in addition to keeping separate accounts, that the operational activities and management are separated for transmission and generation; Legal unbundling: requires that transmission and generation be put in separate legal entities. Under complete unbundling, generation and transmission have to be owned by independent entities. These entities are not allowed to hold shares in both activities.

A link between structural separation and regulatory involvement can be seen in Nigeria and Ghana, which are within the group of countries with greater involvement of the regulator (see Table 2).

The figure below portrays the number of entities per segment in each country. As depicted, Ghana, Nigeria and Senegal have several generation entities (10 or more). Mali is the only country to report more than one transmission company, where the focus of one of them (EDM) is domestic, while the other (SOGEM) is involved in cross-border transmission services. In practice, although SEMAF (which operates the network of SOGEM) is based in Mali, it is also involved in projects in Senegal and Guinea. The countries with more than one distribution company (Disco) are Cabo Verde (ELECTRA and AEB), Ghana (PDS, NEDCo and EPCL), Nigeria (Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port Harcourt and Yola[9]) and Senegal (six private concessions[10] and SENELEC).

Figure 7 – Number of entities per segment



Source: Data collected by the authors

Mali is the only country reporting more than one Transco, though as SEMAF is active in Senegal and Guinea it is arguably not the only example

By expanding competition, improving efficiency, reliability and reducing costs, open access aims to reduce costs, increase quality of service, introduce new products and services, and stimulate

9 In Nigeria there is also a privately-owned licensed distributor that supplies approximately 10,000 customers within Plateau state. However, this is not included in the analysis.

10 "Concessionaires d'Electricité Rurale" under the Rural Electrification Action Plan (PASER)

investment in generation and grid infrastructure, among other (WBG ESMAP 2013). ERERA's Directive on the organization of the ECOWAS Regional Electricity Market (not yet implemented in all member countries) provides for open access to the regional transmission network. At a local level, based on the data received, in ten out of the 15 ECOWAS members countries there is open access to the local transmission network.

Figure 8 – Open Access

Open Access	Restricted Access
• Benin • Burkina Faso • Cabo Verde • Ghana • Liberia • Mali • Niger • Nigeria • Sierra Leone • Togo	• Cote d'Ivoire • Gambia • Guinea • Guinea Bissau • Senegal

Source: Data Collection

Further details on the market structures are set out in Table 43 in Annex I.

B.3 Tariff Methodology

The tariff methodology followed by each country was assessed. The methodologies included in the anlysis are the following:

- **Cost Plus (Rate of Return)**: The Revenue Requirement is determined in a two-stage process, first the total costs of the company are identified, and second a rate of return is established, to provide suitable remuneration for the capital invested.
- **Price cap:** is an incentive-based regulatory approach in which a formula is used to set the maximum yearly price that the company can charge for each service provided over a defined period of several years. These prices are adjusted annually to account for inflation minus a correction factor typically linked with expected increases in productivity.
- **Revenue cap:** is also an incentive-based regulatory approach under which the maximum yearly revenues the company can earn for a period of several years, is calculated using a formula that makes provision for annual inflation less a correction factor associated with expected improvements in productivity. These revenues may be adjusted annually in accordance with one or several cost or revenue drivers that are beyond the control of the regulated company, such as the number of consumers, total energy supplied or, in the case of network companies, the size of the network.
- **Hybrid:** a combination of different methodologies.

Figure 9 – Tariff Methodology

Cost Plus	Price Cap	Revenue Cap	Hybrid
• Benin • Cote d'Ivoire • Gambia • Liberia • Mali • Sierra Leone • Guinea • Guinea Bissau	• Cabo Verde • Niger • Senegal	• Burkina Faso • Togo	• Ghana • Nigeria

Source: Data collected by the authors

The hybrid models are different in several respects. In Ghana, PURC describes its hybrid regime as a combination of cost-plus revenue requirement and performance-based incentive mechansims.[11] The Multi-Year Tariff Order regime in Nigeria is described by NERC as providing the benefits of price cap and incentive-based regulation through a single accounting framework.[12]

Recent relevant changes in local tariff methodologies include:

- Burkina Faso: Introduction of a new methodology and parameters to set transmission and distribution tariffs in July 2018,
- Ghana: Issuing of new rate setting guidelines for electricity distribution and supply in 2018,
- Niger: Introduction of a new tariff structure in 2017

Tariff setting in the member countries starts from an estimate of appropriate costs, of which an important component is the capital-related costs. The table below provides information regarding the Weighted Average Cost of Capital (WACC) or discount rate considered in each country for tariff setting purposes. Key values for the gearing (capital structure) vary significantly. For example, Mali considers a proportion of debt of 20% on its WACC calculation, whereas Ghana and Nigeria use 70%. This may be due to different risks, access to credit and the evolution of the banking sector. For example, Nigerian banks were heavily involved in financing the purchasers of privatized electricity assets and are heavily involved in the energy sector generally. In general, the view of investors regarding relative market risk varies, for example, Damodaran (2019) reports a country risk premium of 10.41% in Mali, compared to 9.03% in Ghana and 7.64% in Nigeria.

11 Targets are built into the price path for transmission and distribution losses, and collection rates.
12 https://nerc.gov.ng/index.php/home/myto (accessed October 2019).

The countries officially reporting a WACC are the following :

- Nominal before tax: Cabo Verde 6.5% and Gambia 13.0%
- Real before tax: Nigeria 11.0% and Senegal 10.7%
- Real after tax: Mali 8.0%

It is common practice to compare real after tax WACC. Thus, the formulas included in Annex III and the inflation rates and profit tax rates included in the macroeconomic indicators (Annex I) are used to harmonise the rates obtaining the following real after tax WACC for the countries with data:

- Cabo Verde: 3.9%
- Gambia: 5.3%
- Nigeria: 6.4%
- Mali: 8.0%
- Senegal: 8.9%

Table 3 – Cost of Capital as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau*	Liberia*	Mali	Niger*	Nigeria	Senegal	Sierra Leone	Togo
Methodology	WACC will be impleme nted	WACC will be impleme nted	WACC	WACC not followed	WACC	WACC	WACC not followed	WACC not followed	WACC will be impleme nted	WACC	WACC	WACC	WACC	WACC will be impleme nted	WACC not followed
Currency			LCU		LCU	LCU				LCU	LCU	LCU	LCU		
Description			Nominal before tax		Nominal before tax	Nominal before tax			Real after tax	Real after tax	Real after tax	Real before tax	Real before tax		
Proportion of equity			30.0%			30.0%			10.0%	80.0%	44.6%	30%	55.0%		
Proportion of debt			70.0%			70.0%			90.0%	20.0%	55.4%	70%	45.0%		
Currency			LCU			USD			USD	LCU	LCU		EUR		
Frequency of adjustment			Per tariff cycle (5 years)		Per tariff cycle (1 year)				Per tariff cycle (3 years)	Per tariff cycle (5 years)	Per tariff cycle (5 years)	Semi-annual minor review	Per tariff cycle (3 years)		
Cost of capital rate															
- Generation			6.5%		13%			10%	3.3%	8.0%	6.0%	11.0%	10.7%		
- Transmission			6.5%		13%			10%	3.3%	8.0%	6.0%	11.0%	10.7%		
- Distribution			6.5%		13%			10%	3.3%	8.0%	6.0%	11.0%	10.7%		

* Corresponds to the cost of capital / discount rate considered in the tariff setting process

Source: Data collected by the authors

Summary findings – tariff frameworks

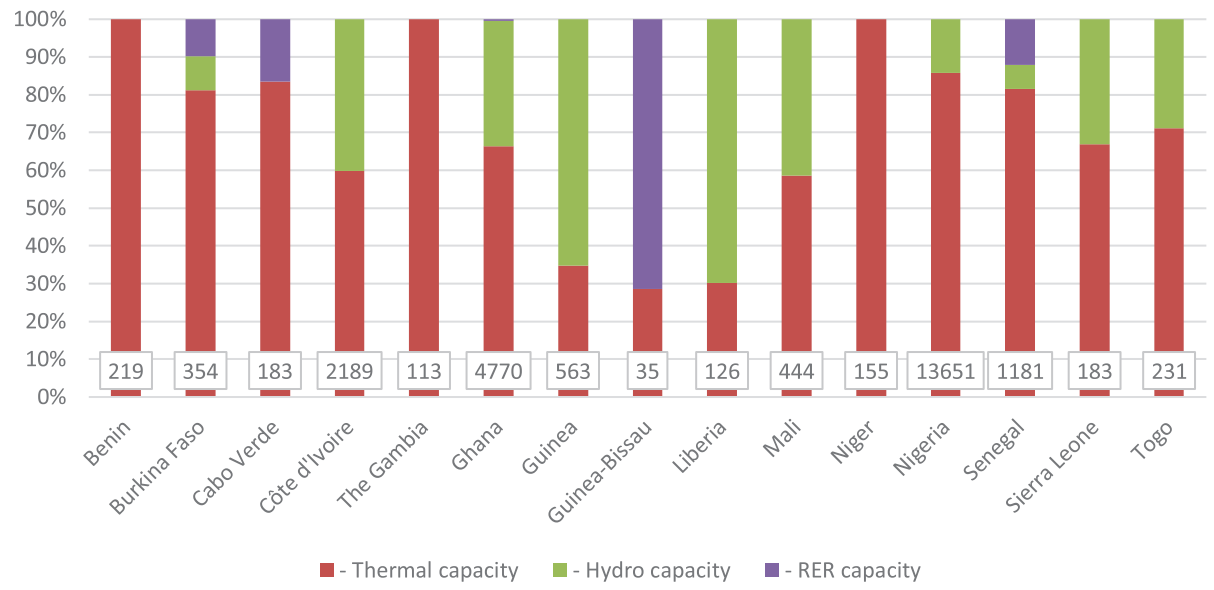
- *There is no clear trend in regulatory models and governance: The role of the regulator varies significantly, though in most countries it is the regulator – rather than the Ministry - who is responsible to set prices.*
- *Cost based approaches to set prices are predominant, though several variations exist in converting regulatory revenues to prices (price cap, revenue cap, hybrids etc.,)*
- *Industry structure has evolved to permitting IPPs in all cases. While roughly half of the countries still have vertically integrated entities, there is an ongoing trend towards structural separation.*
- *Open access to transmission networks is repòrted in 60% of the countries considered.*

C. Bulk Generation Tariffs (BGT)

C.1 Generation Mix

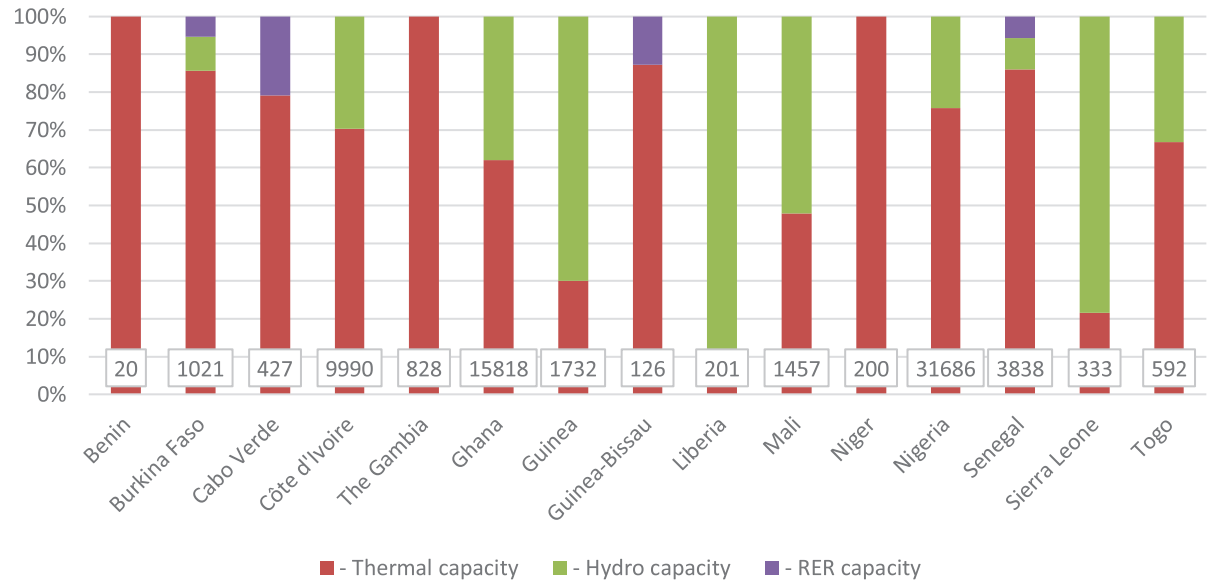
The capacity (MW) and electricity production (GWh) of on-grid systems located within the country is portrayed in the next two figures.

Figure 10 – Capacity in MW (on-grid system) as of 2018



Source: Data collected by the authors

Figure 11 – Electricity production in GWh (on-grid system) as of 2018



Source: Data collected by the authors

The reported production for Benin is well below actual demand as it only reflects production from small thermal plants located within the country and excludes imports and purchases from CEB[13].

Complementing the information presented above, the table below provides Peak Demand (MW), and the ratio of Peak Demand to On-grid capacity. Only on-grid capacity was used given that off-grid capacity for all countries was not available. In some cases, large off-grid capacity is available - Cote d'Ivoire has additional off-grid capacity of 6.7 MW, Gambia 5.7 MW, Guinea 54.8 MW – albeit mostly currently unavailable -, Liberia 4.7 MW, Mali 73.6 MW, Niger 52.4 MW, Senegal 67.9 MW and Togo 15.4 MW). The Peak Demand to On-grid capacity ratios presented below are expected to be lower for countries with off-grid installed capacity.

Table 4 – Peak Demand

	Peak demand (MW)	On-grid Capacity (MW)	Ratio: Demand / On-grid Capacity
Liberia	22	126	0.18
Guinea-Bissau	38	35	1.09
The Gambia	70	113	0.62
Cabo Verde	74	183	0.40
Sierra Leone	125	183	0.68
Niger	154	155	0.99
Benin	222	219	1.02
Togo	231	231	1.00
Burkina Faso	326	354	0.92
Guinea	340	563	0.60
Mali	353	444	0.80
Senegal	642	1201	0.53
Côte d'Ivoire	1388	2189	0.63
Ghana	2371	4770	0.50
Nigeria	16660	10687	1.55*

*See explanation below

Source: Data collected by the authors

The values in the table for certain countries require clarification. In Benin, peak demand is largely met by capacity located outside the country (not shown in this table)[14], while the peak demand shown from Nigeria – from the current TCN Transmission Expansion Plan[15] – includes suppressed demand, which the authors note represents almost two-thirds of the total peak demand. Similarly, effective on-grid capacity in Nigeria has been well below the estimate for 2018 included above.

To compare generation costs, which vary significantly according to fuel/source, the following classification of countries was made:

- **Predominantly Hydro:** countries with 50% or more of electricity produced with hydro
- **Predominantly Thermal:** countries with 50% or more of electricity produced with thermal sources

13 In practice local production will rise given the commissioning of the Maria Gleta 120 MW thermal plant in August 2019.
14 Moreover, the reported local capacity available in 2018 overstates the effective capacity.
15 TCN, Transmission expansion plan, December 2017.

Considering the electricity produced in 2018 (excluding off-grid systems), the following distribution arises, with the figure below depicting four countries as predominantly hydro: Guinea (70%), Liberia (90%), Mali (52%) and Sierra Leone (78%).

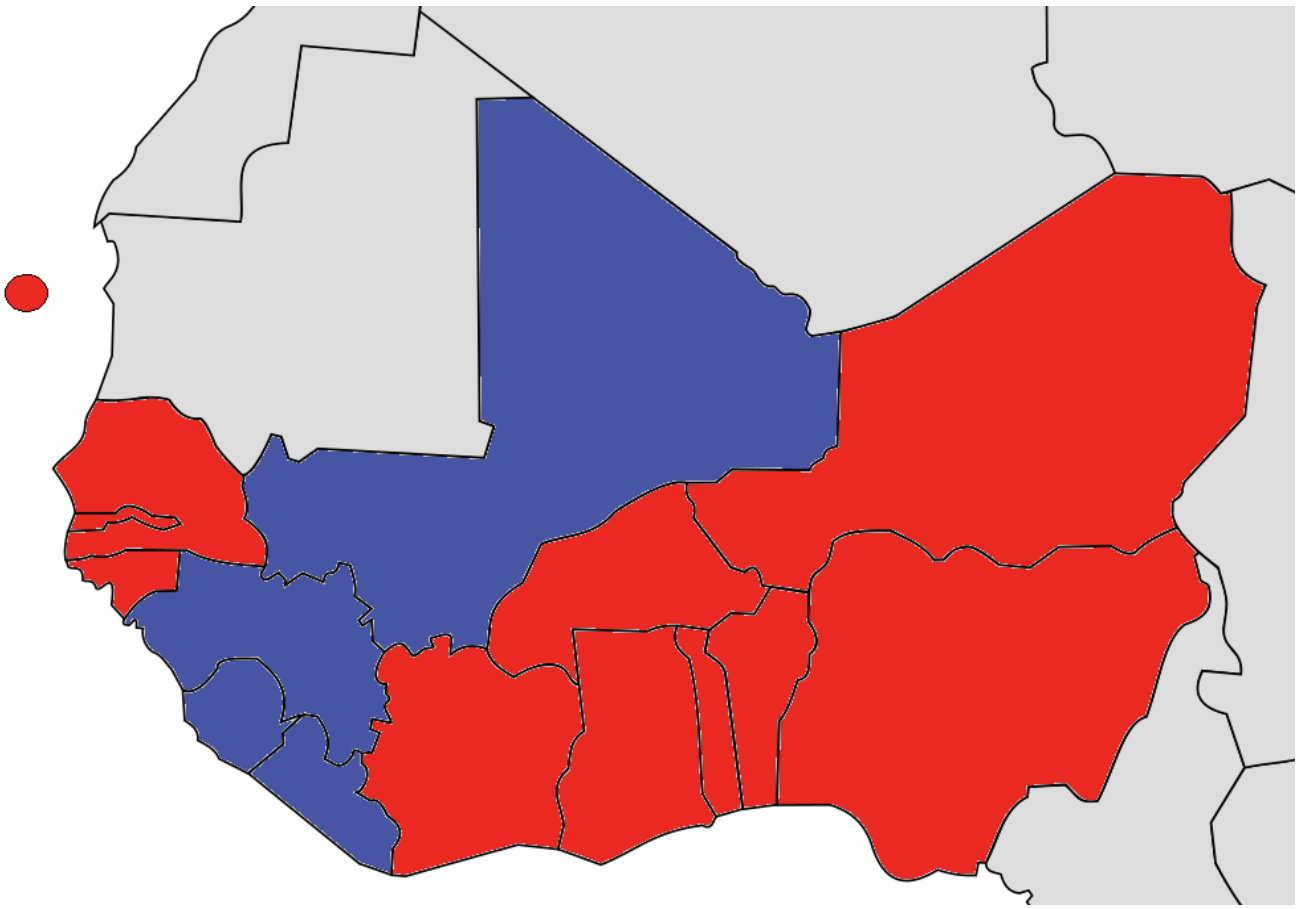


Figure 12 – Predominantly Hydro vs. Predominantly thermal

Predominantly hydro

Predominantly thermal

Source: Data collected by the authors

At least eleven Member countries are involved in electricity trade. Benin, Burkina Faso, Mali, Niger, Senegal and Togo are net importers with significant volumes of cross-border trade.

Table 5 – Cross-Border electricity trade in 2018

	Cross-border electricity exports (GWh)	Cross-border electricity imports (GWh)	Net import of electricity (Imports - Exports) (GWh)
Benin	0	1299	1,299
Burkina Faso	0	783	783
Cabo Verde	0	0	0
Côte d'Ivoire	1,078	16	-1,062
The Gambia	0	11	11

Ghana	740	140	-600
Guinea	No data available		
Guinea-Bissau	No data available		
Liberia	0	0.01	0.01
Mali	0	459	459
Niger	0	964	964.3
Nigeria	2,802	0	-2,802.2
Senegal	11	321	310.3
Sierra Leone	0	0	0
Togo	4.6	1532	1449

Source: WAPP and Data collected by the authors

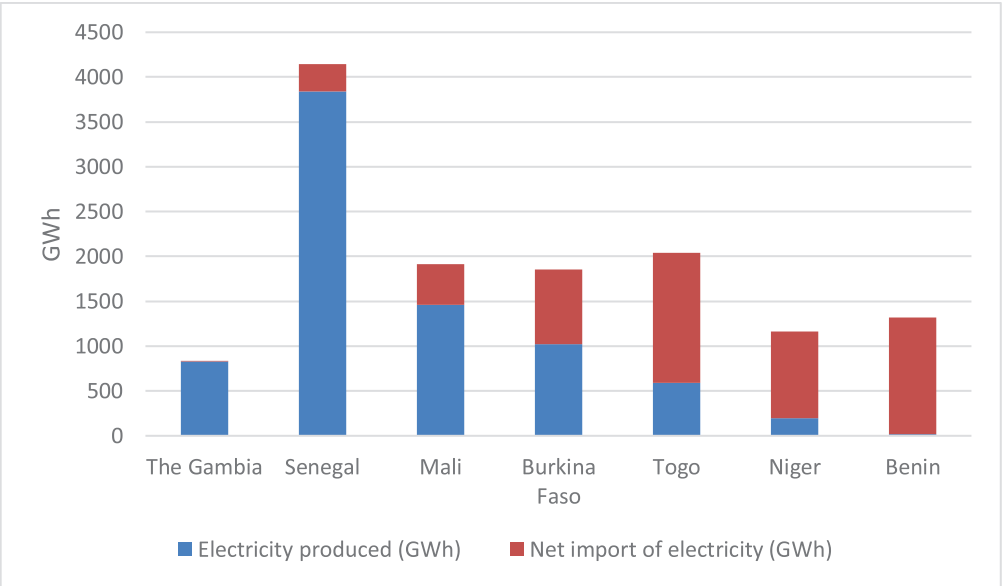
For net importers of electricity, the following table assesses the weight of net imports, as a proportion of electricity produced plus net imports. The importance of electricity imports is particularly marked in Benin, Niger, Togo and Burkina Faso.

Table 6 – Share of electricity imports in net importer countries

	Electricity produced (GWh)	Net import of electricity (GWh)	Electricity produced + net electricity imports (GWh)	Net electricity import / (Production + Net electricity import)
The Gambia	828	11	839	1.3%
Senegal	3838	310	4148	7.5%
Mali	1457	459	1916	24.0%
Burkina Faso	1021	837	1857	45.0%
Togo	592	1449	2040	71.0%
Niger	200	964	1164	82.8%
Benin	20	1299	1319	98.5%

Source: Data collected by the authors

Figure 13 – Net electricity importers: breakdown of imports and own production



Source: Data collected by the authors

Source: Data collected by the authors

A possible indicator to measure the level of development of the regional market (i.e. the level of trade) is the total export of electricity[16] as percent of total electricity produced in the region (both in GWh). Using the 2018 WAPP-ICC annual operations report, total export of electricity was 5718.7 GWh and total electricity produced was 67376.1. Thus, as of 2018 exports of electricity in the region reached 8.5% of electricity production. It is suggested to track the evolution of this indicator in time to assess the development of the regional market.

C.2 Nominal BGT

In Nigeria the regulator determines the generation costs paid by the distribution companies. Similarly, the regulator in Ghana approves the price at which electricity generators sell to distribution companies and includes in the gazetted tariff schedule a Bulk Generation Tariff (USD/MWh), which is a weighted average price of projected electricity supply from all generation sources. For the rest of the countries, a proxy BGT is estimated from data on the average cost of production and price paid to generators and IPPs. The results from this methodology show a wide variation, with a more than six times variation between the lowest (Liberia) and the highest (Niger).

Table 7 - BGT (USD/MWh) as of 2018

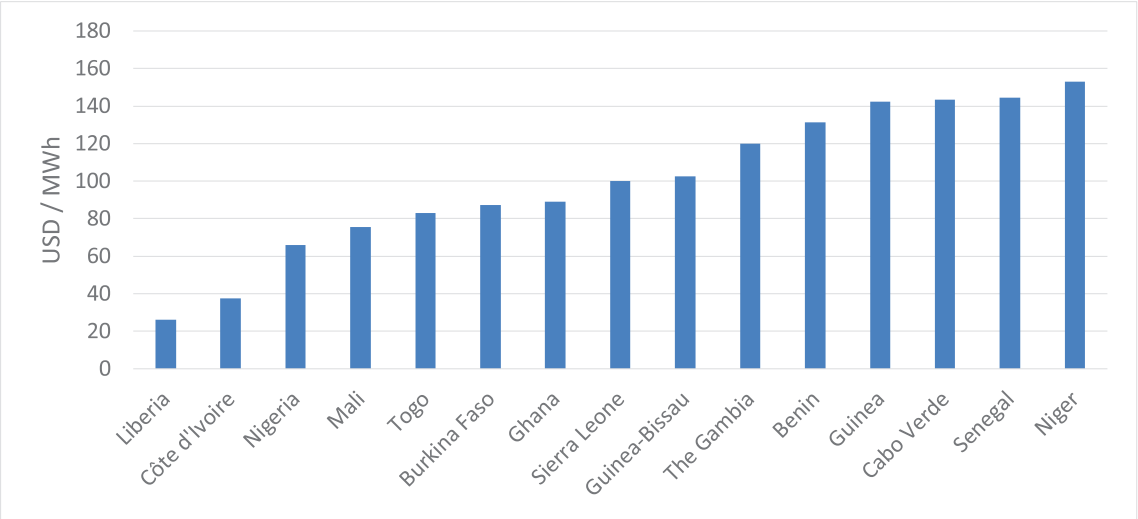
	BGT (USD/MWh)	Description
Liberia	26	Weighted average cost of production
Côte d'Ivoire	38	Weighted average payments to generators
Nigeria	66	Weighted average payments to generators
Mali	76	Weighted average contract prices
Togo	83	Weighted average payments to generators
Burkina Faso	87	Generation expenditures / electricity produced
Ghana	89	Composite Bulk Generation Charge (VRA + IPPs)
Sierra Leone	100	Generation expenditures / electricity produced
Guinea-Bissau	102	Generation expenditures / electricity produced
The Gambia	120	Cost of generation (grid)
Benin	131	Average cost of electricity imported: TCN, VRA, CIE and ECG
Guinea	142	Generation expenditures / electricity produced
Cabo Verde	143	Weighted average of purchase price from IPPs
Senegal	144	Weighted average generation cost
Niger	153	Weighted average generation cost and contract prices
Median	100.0	

Source: Data collected by the authors

16 Imports can be used aswell, which should be a similar indicator, the difference being electricity losses

Figure 14 – Average BGT (USD/MWh) as of 2018

16 Imports can be used aswell, which should be a similar indicator, the difference being electricity losses



Source: Data collected by the authors

C.3 Key underlying drivers of BGT

A key expected driver of differences in BGT between countries is the share of hydro in the generation mix. The high-level data, does suggest the share of hydro is key to suppressing generation costs, with 7 of the 8 countries with the lowest BGTs having a share of hydro above 20% in the total generation mix. However, the data is not conclusive, as for example, Guinea with a high share of hydro production reports one of the highest estimated BGTs. The mixed signals, summarized below suggest a need to delve deeper into country-specific factors, particularly for thermal generation costs.

Table 8 – Comparison between share of hydro and BGT – countries with more than 20% of generation from hydro

Ranking for BST	Country	Share of hydro production	BGT (USD/MWh)
1	**Liberia**	90%	26.1
2	**Côte d'Ivoire**	30%	37.5
3	**Nigeria**	24%	66.0
4	**Mali**	52%	75.7
5	**Togo**	33%	83.1
7	**Ghana**	38%	89.2
8	**Sierra Leone**	78%	100.0
12	**Guinea**	70%	142.2

Source: Data collected by the authors

In evaluating key drivers of thermal power costs, several factors have been considered, the first of which is the weighted average heat rate (BTU/kWh). Data was not obtained for eight countries, though four of these are hydro-predominant countries where heat rates are not key drivers.

Considering that as of 2017 in the US, the average heat rate of Coal was 10465 BTU/kWh, Petroleum was 10834 BTU/kWh, Natural Gas was 7812 BTU/kWh, the following observations arise:

- The average heat rate of local plants in Benin is high, albeit this is partly explained by the fact that it is mainly producing electricity with Diesel, and as mentioned before, most electricity consumed in Benin is imported.
- The average heat rate of Cote d'Ivoire is high, considering it is mainly producing electricity with Natural Gas (however, Cote d'Ivoire has one of the lowest proxies of BGT considered).
- The average heat rate in Cabo Verde, where thermal generation is derived from Diesel and HFO, appears within an acceptable range of efficiency for the fuels used. Similarly, the heat rate in Senegal appears acceptable.
- The average heat rate in Ghana appears relatively high given that over 66% of Ghana's thermal generation is produced with Natural Gas.

Table 9 – Heat rate (BTU/kWh, weighted average), 2018

Country	Heat rate
Togo	7567.621
Ghana	8656.93
Senegal	9021.535
Burkina Faso	9032.956
Cabo Verde	9170.353
Côte d'Ivoire	9183.45
Benin	13739.21
The Gambia	No data available
Guinea	No data available
Guinea-Bissau	No data available
Liberia	No data available
Mali	No data available
Niger	No data available
Nigeria	No data available
Sierra Leone	No data available

Source: Data collected by the authors

To complement the efficiency analysis, the price of main fuels in each country was assessed in the table below. While limited data was obtained, the price of main fuels, for example Natural Gas, can be much higher in non-producing countries, which is expected to put pressure on the BGT.

Guinea	No data available		
Guinea-Bissau	No data available		
Liberia	No data available		
Mali*		89	99
Niger**		83	
Nigeria	3.3		
Senegal		72	108
Sierra Leone	No data available		
Togo	No data available		

*2016
**Gorou Banda
***Subsidized

Source: Data collected by the authors

The second driver analysed is the weight of fuel, variable and fixed costs in operating costs of thermal generation, as portrayed below. Thus, this driver considers only thermal production. Countries with high components of fuel cost (i.e. more vulnerable to external shocks in international price of oil) are Benin, Senegal and Togo. This is particularly relevant for countries using oil derived fuels to supply the peak, such as Benin (HFO), Niger (Diesel), Senegal (Diesel) and Togo (Diesel)[17]. While data was not received from Cabo Verde, extensive use of HFO and the need to transport fuel by sea are believed to be key cost drivers.

Table 11 – Components of operating cost, 2018

	Fuel (%)	Variable OPEX (%)	Fixed OPEX (%)
Benin*	96.1%	3.9%	
Burkina Faso	No data available		
Cabo Verde	No data available		
Côte d'Ivoire	56.1%	43.9%	
The Gambia	No data available		
Ghana*	32.1%	67.9%	
Guinea	No data available		
Guinea-Bissau	No data available		
Liberia	71.7%	16.8%	11.6%
Mali	69.1%	15.7%	15.0%
Niger	43.9%	56.1%	
Nigeria	69.1%	23.4%	7.5%
Senegal	86.2%	13.8%	
Sierra Leone	No data available		
Togo	81.0%	19.0%	

*Data for SBEE
**Data for VRA

Source: Data collected by the authors

Another driver of BGT considered was availability factor and capacity factor, portrayed in the table below. Of those countries reporting data, Ghana and Mali present the lowest capacity factors.

17 Non-exhaustive list due to missing data

Table 12 – Availability and capacity factor (%, weighted average), 2018

	Availability factor (%)	Capacity factor (%)
Benin	No data available	
Burkina Faso	No data available	65%
Cabo Verde	79%	No data available
Côte d'Ivoire	74%	60%
The Gambia	72%	No data available
Ghana	85%	33%
Guinea	No data available	
Guinea-Bissau	No data available	
Liberia	No data available	
Mali	85%	43%
Niger	100%	80%
Nigeria	81%	No data available
Senegal	87%	65%
Sierra Leone	No data available	
Togo	97%	57%

Source: Data collected by the authors[18]

Further details on the drivers of BGTs are included in Table 47 in Annex I.

Summary findings – BGT

- *Four countries produce more than half their electricity from hydro, while a further three countries produce more than 30% of their energy from hydro.*
- *Thermal power continues to be the predominant source of generation.*
- *Five countries place strong reliance on imports of electricity (more than 20% of their total demand) to meet their domestic needs, the development of cross-border transmission entities reflects this requirement.*
- *There is a significant variation in proxy BGTs estimated from cost data. Some of this variation can be explained by hydro production and the heat rate and plant availability of thermal plants. However, notwithstanding large data gaps, there remains an unexplained element, which requires greater understanding of cost drivers.*

18 The 100% availability factor in Niger is above expectations but was confirmed by the Focal point.

D. Transmission Tariffs

D.1 Nominal TT

Four member countries have a Transmission Tariff: Ghana, Nigeria, Togo and Benin. In the case of Benin, CEB, which has its Headquarters in Togo, charges SBEE to use its network. For six other countries a proxy transmission tariff has been developed based on data reported on the share of transmission in the overall tariff (see Table 32).

Table 13 – Transmission Tariff

	Transmission Tariff (USD/MWh)	Estimate of Transmission Tatiff (USD/MWh)
Benin	17.4	-
Burkina Faso	-	No data available
Cabo Verde	-	24.2
Côte d'Ivoire	-	9.3
The Gambia	-	No data available
Ghana	8.7	-
Guinea	-	3.7
Guinea-Bissau	-	14.9
Liberia	-	66.5
Mali	-	10.4
Niger	-	No data available
Nigeria	12.8	-
Senegal	-	No data available
Sierra Leone	-	No data available
Togo	17.4	-
Median	9.3	

Source: Data collected by the authors

The data shows that in seven of the nine countries where comparison is possible the transmission tariff is bounded within the range 9-18 USD/MWh. Except Guinea-Bissau, all have extensive transmission networks operating at 161kV or above (see Table 14).

Countries calculating a transmission tariff consider historical O&M costs and the Regulatory Asset Base of key assets. In Nigeria, quality of service targets for TCN are set in the MYTO, including a maximum transmission loss target of 8.05%. PURC has applied a loss target of 3.8% for Gridco in Ghana.

D.2 Key underlying drivers of TT

A key distinction to consider, is that transmission is defined differently across the region. The table below summarizes injection levels of transmission considered by the regulator in each country.

Table 14 – Injection level of Transmission (kV)

	Above 300kV	200-300kV	100-200kV	Below 100kV
Benin*	-	-	161	-
Burkina Faso*	-	225	132	90
Cabo Verde	-	-	-	60
Côte d'Ivoire	-	225	-	90
The Gambia*	-	-	-	33, 11
Ghana*	330	225	161	69
Guinea*	-	225	110	60
Guinea-Bissau	-	-	-	30
Liberia	-	-	-	66
Mali*	-	225	150	-
Niger	-	-	132	66
Nigeria	330	-	132	-
Senegal	-	225	-	90
Sierra Leone	-	-	161	-
Togo	-	-	161	-

*Assumption of Consultant based on voltage of transmission network

Source: Data collected by the authors

For regional trade, the relevant voltage level is 132 kV or as agreed by ERERA (Resolution N°006/ERERA/15, Adoption of the Methodology for Regional Transmission Cost and Tariff).

The first driver of transmission costs analyzed is the transmission losses included in the tariff, portrayed in the table below. Data is not available for the full sample, with Niger and Nigeria presenting the highest reported losses of the countries reporting this measure.

Table 15 – Transmission losses (%)

	Transmission losses (%)
Benin	5.4%
Burkina Faso	2.3%
Cabo Verde	No data available
Côte d'Ivoire	6.0%
The Gambia	No data available
Ghana	4.4%
Guinea	No data available
Guinea-Bissau	No data available
Liberia	No data available
Mali	No data available
Niger	12.7%
Nigeria	8.4%
Senegal	2.8%
Sierra Leone	No data available
Togo	5.8%

Source: Data collected by the authors

Second, drivers of transmission costs considered concern assets: number and capacity of transformers, and network length. In general, the countries with the lower TT's (actual and proxy) are those with the most extensive transmission network and transformer capacities (e.g., Ghana, Côte d'Ivoire, Nigeria) as portrayed in the tables below.

Table 16 – Transmission transformer capacity

	Transformer capacity (MVA)	Number of transformers
Benin	865	19
Burkina Faso	No data available	
Cabo Verde	No data available	
Côte d'Ivoire	5,396	132
The Gambia	104	8
Ghana	7,191	134
Guinea	370	No data available
Guinea-Bissau	No data available	
Liberia	92	5
Mali	No data available	
Niger	546	13
Nigeria	16,818	137
Senegal	3,026	58
Sierra Leone	195	5
Togo	1,400	22

Source: Data collected by the authors

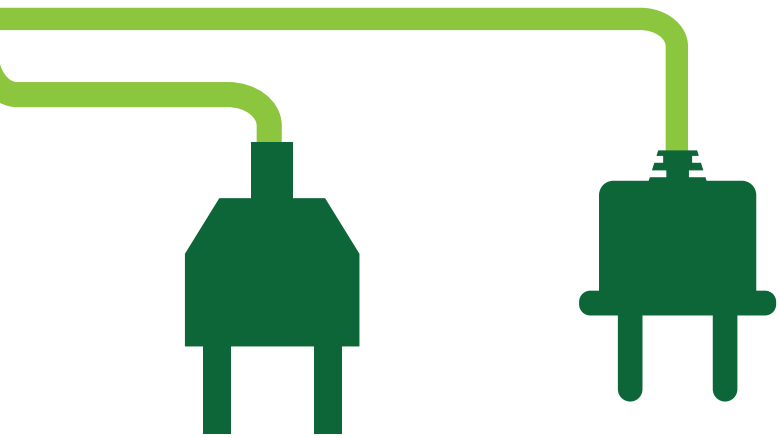


Table 17 – Transmission network length

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Network length (km) – Transmission	**6,251**	**1,408.3**	**79.4**	**5,413**	**533**	**5,610**	**550.7**	**110**	**81.1**	**2,324.6**	**1,549.6**	**12,325**	**580.52**	**205**	**2,038.3**
- 330 kV	520					374						5,523.8			243
- 225 kV		753.4		2,790		73	115.9						324.74		
- 161 kV	5,731					4950								205	1,328.1
- 132 kV		315									995.45	6,801.5			
- 110 kV							352.8								
- 90 kV		138		2,623									255.78		
- 69 kV						213									
- 66 kV									81.1		554.1				
- 63 kV															251.0
- 60 kV			79.4				82								
- 34.5 kV															35.8
- 33 kV		201.9			277										180.4
- 30 kV								110							
- 11 kV					256										

Source: Data collected by the authors

Summary findings – TT

- *Four countries have an explicit TT, in other cases a proxy TT has been estimated, which shows that a typical TT is within the range of $9-18/MWh*
- *Countries with an estimated TT above this range have small transmission networks and operate at relatively low voltages.*
- *More generally, there appears some evidence of economies of scale as the countries with larger networks operating at higher voltage appear to have lower unit costs.*
- *There are a wide number of voltage levels used within the region.*

E. End-User Tariffs

E.1 Nominal EUT

The level and structure of charges (fixed/capacity/energy) of each country are portrayed below. Details of customer categories are included in Table 48 in Annex I.

Charges are defined as follows:

- Fixed charge: monthly service charge that is billed to the client regardless of the demand and consumption of the month,
- Capacity charge (Demand charge): monthly charge that is billed to the client due to contracted capacity,
- Energy charge: monthly charge that is billed to the client due to the electricity consumption, including:
  - Flat tariff: a single value for all kWh consumed, regardless of the level of consumption[19]
  - Consumption block: different prices applied to the kWh according to consumption levels
  - TOU: different prices depending on the time of day in which the consumption is made (e.g. peak, off-peak)

There is widespread use of different types of charges. All five types considered (i.e. fixed charge, capacity charge and the three types of energy charge) are employed in Burkina Faso, Cote d'Ivoire, Mali, Niger and Togo.

Table 18 – Structure of charges

	Fixed charge	Capacity charge	Energy Charge		
			Flat	Block	TOU
Benin	Y	Y	Y	Y	N
Burkina Faso	Y	Y	Y	Y	Y
Cabo Verde	Y	Y	Y	Y	N
Côte d'Ivoire	Y	Y	Y	Y	Y
The Gambia	N	N	Y	Y	N
Ghana	Y	Y	Y	Y	N
Guinea	Y	Y	Y	Y	N
Guinea-Bissau	Y	N	Y	Y	N
Liberia	N	N	Y	N	N
Mali	Y	Y	Y	Y	Y
Niger	Y	Y	Y	Y	Y
Nigeria	N	N	Y	N	N
Senegal	N	Y	Y	Y	Y
Sierra Leone	Y	N	Y	Y	N
Togo	Y	Y	Y	Y	Y

Source: Data collected by the authors

19 It is worth noting that this does not imply that all customer categories pay the same tariff (which is the case in Liberia only)

The concurrent presence of flat and block tariffs in several countries reflects cases where flat tariffs are applied to certain commercial/industrial customer categories and block tariffs to domestic customers.

In six countries TOU tariffs are applied to higher voltages/contracted demands. The blocks considered and the average tariffs per TOU block are depicted in the tables below. In Burkina Faso and Mali, the highest ratio between peak and off-peak tariffs is observed, with peak hour tariffs twice those of off-peak tariffs.

Table 19 – Countries with TOU tariffs - blocks

	Peak	Mid-peak	Off-peak
Burkina Faso	10:00 – 14:00 and 16:00 – 19:00; or 10:00 - 24:00 (depends on category)		00:00 – 10:00, 14:00 – 16:00 and 19:00 - 24:00, or 00:00 – 10:00 (depends on category)
Cote d'Ivoire	19:30 – 23:00	07:30 – 19:30 and 23:00 - 24:00	00:00 – 07:30
Mali	18:00 – 24:00	06:00 – 18:00	00:00 – 06:00
Niger	10:00 – 16:00		00:00 – 10:00 and 16:00 – 24:00
Senegal	19:00 – 23:00		00:00 – 19:00 and 23:00 – 24:00
Togo	18:00 – 23:00	06:00 – 18:00	23:00 – 06:00

Source: Data collected by the authors

Table 20 – Countries with TOU tariffs – average tariff per block (USDc/kWh)

	Peak	Mid-peak	Off-peak	Percent increase peak with respect to off-peak
Burkina Faso	24.4		12.2	100.0%
Cote d'Ivoire	14.0	10.2	8.3	68.2%
Mali	19.1	13.0	9.5	100.0%
Niger	13.4		9.3	45.0%
Senegal	22.4		14.7	52.6%
Togo	16.3	14.4	13.1	24.9%

Source: Data collected by the authors

The applicable schedule for a typical Domestic LV consumer in each country is portrayed in the table below. The table portrays the applicable charges and blocks for the selected categories only. For example, Guinea Bissau, Mali and Togo have 2, 2 and 3 energy charging blocks respectively for the chosen Domestic LV category. In total, these three countries have 3, 4 and 4 charging blocks respectively, but not all these blocks apply to the chosen Domestic LV category. Similarly, no capacity charges apply to the Domestic LV category of Cabo Verde, Ghana, Guinea, Mali, Niger and Senegal, but capacity charges apply to other commercial/industrial categories.

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Table 21 - Domestic LV tariff schedule (without taxes)

	Category	Tariff type	Fixed charge (Y/N)	Fixed charge (USD/Month)	Capacity charge (Y/N)	Capacity charge (USD/kW or kVA)	Number of blocks	Size of the first block (kWh)	Price first block (USDc/kWh)	Price highest block (USDc/kWh)	% increase from first block to highest block	Is there pre-paid category ?
Benin	BT1	Block	N	-	Y	0.9	3	20	13.5	20.0	47.4%	N
Burkina Faso	B1	Block	Y	3.1	N	-	3	50	16.7	18.9	13.5%	N
Cabo Verde	BTN Monofásico <= 10 Amperes	Block	Y	0.4	N	-	2	60	23.5	30.6	30.4%	N
Côte d'Ivoire	Category Domestique General BT	Block	N	-	Y	2.2	2	180	11.6	10.1	-13.3%	Y
The Gambia	Domestic	Block	N	-	N	-	4	300	20.5	23.3	13.8%	Y
Ghana	Residential (other residential)	Block	Y	1.3	N	-	4	50	5.7	16.6	189.3%	N
Guinea	BT domestique prive mono	Block	Y	0.5	N	-	3	60	1.0	3.2	224.4%	N
Guinea-Bissau	Tariff LV normal	Block	Y	6.3	N	-	2	200	22.2	42.5	91.4%	N
Liberia	Residential	Flat	N	-	N	-	1	-	35.0	35.0	-	N
Mali	BT - Tarif normal	Block	Y	0.9	N	-	2	200	18.9	22.6	19.3%	Y
Niger	BT general domestique 3kW	Block	Y	2.2	N		3	150	11.9	22.1	86.1%	Y
Nigeria	R2	Flat	N	-	N	-	1	-	7.8	7.8	-	N
Senegal	DPP	Block	N	-	N	-	3	150	15.7	17.6	12.3%	Y
Sierra Leone	T1 Residential	Block	Y	1.3	N	-	2	50	6.7	16.9	152.7%	N
Togo	BT domestique puissance souscrite supérieure a 2.2 kVA et inférieure á 13.2 Kva	Block	Y	1.7	Y	0.5	3	200	14.6	20.8	42.9%	Y

Source: Calculations based on Data collected by the authors

The following standard consumer profiles were constructed to compare tariffs between countries:

Table 22 – Standard consumers

Nº	Description	Subscribed demand (kW)	Monthly consumption (kWh)
1.1	Social LV Consumer	1	50
1.2	Social LV Consumer	1	100
2.1	Single phase Domestic LV Consumer	2	250
2.2	Single phase Domestic LV Consumer	4	500
3.1	Three-phase Domestic LV Consumer	6	500
3.2	Three-phase Domestic LV Consumer	12	1000
4.1	Non domestic LV Consumer	2	500
4.2	Non domestic LV Consumer	6	1000
4.3	Non domestic LV Consumer	12	1800
4.4	Non domestic LV Consumer	20	2500
5	Street light	20	2500
6.1	MV Consumers	250	40000
6.2	MV Consumers	600	100000
6.3	MV Consumers	1 000	250000
7	HV Consumers	10 000	12000000

Note: Reactive energy: no penalty; TOU: 90% of consumption in off-peak hours, 10% of consumption in peak hours,

Source: ERERA "Benchmarking ECOWAS DISCO tariff"

The results for all standard consumers are included in Table 49, Table 50, Figure 24 and Figure 25 in Annex I.

The table and figure below provide the calculated tariffs including taxes and charges for the following selection of standard consumers:

- 1.1. Social LV Consumer (demand = 1kW, consumption = 50 kWh)
- 2.1. Single phase Domestic LV Consumer (demand = 2kW, consumption = 250 kWh)
- 3.1. Three-phase Domestic LV Consumer (demand = 6kW, consumption = 500 kWh)
- 4.1. Non-domestic LV Consumer (demand = 2kW, consumption = 500 kWh)
- 6.1. MV Consumer (demand = 250kW, consumption = 40000 kWh)

Description of the applicable taxes and charges considered is provided further in Table 25.

Table 23 - Electricity end-user tariff in US cents per kWh (with taxes and charges) as of 2018

	Description	kW	kWh	Benin	Burkina	Cabo Verde	Côte d'Ivo.	Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo	Median
				SBEE	SONABEL	ELECTRA	CIE	NAWEC	ECG	EDG	EAGB	LEC	EDM	NIGELEC	ABUJA	SENELEC	EDSA	CEET	
1.1	Social LV Consumer	1	50	24.9	16.9	28.0	8.4	20.5	7.0	2.4	17.3	38.5	11.0	14.5	1.4	18.9	11.9	16.2	16.2
2.1	Single phase Domestic LV Consumer	2	250	23.7	21.8	33.4	22.0	20.5	11.4	2.6	33.3	38.5	23.7	16.4	8.2	19.9	12.6	18.2	20.5
3.1	Three-phase Domestic LV Consumer	6	500	24.7	27.6	35.1	22.2	20.8	13.2	3.0	35.7	38.5	25.5	22.1	8.2	22.1	13.6	22.1	22.1
4.1	Non domestic LV Consumer	2	500	23.7	23.7	32.1	18.6	25.3	15.6	13.2	42.3	38.5	25.1	21.5	12.4	28.2	17.2	23.2	23.7
6.1	MV Consumer	250	40000	19.8	18.8	32.8	17.3	27.1	19.7	25.3	22.2	38.5	13.7	19.8	15.7	24.0	19.6	21.4	19.8

Notes: taxes and charges of country are presented in Table 25 – EUT taxes, levies and charges applicable

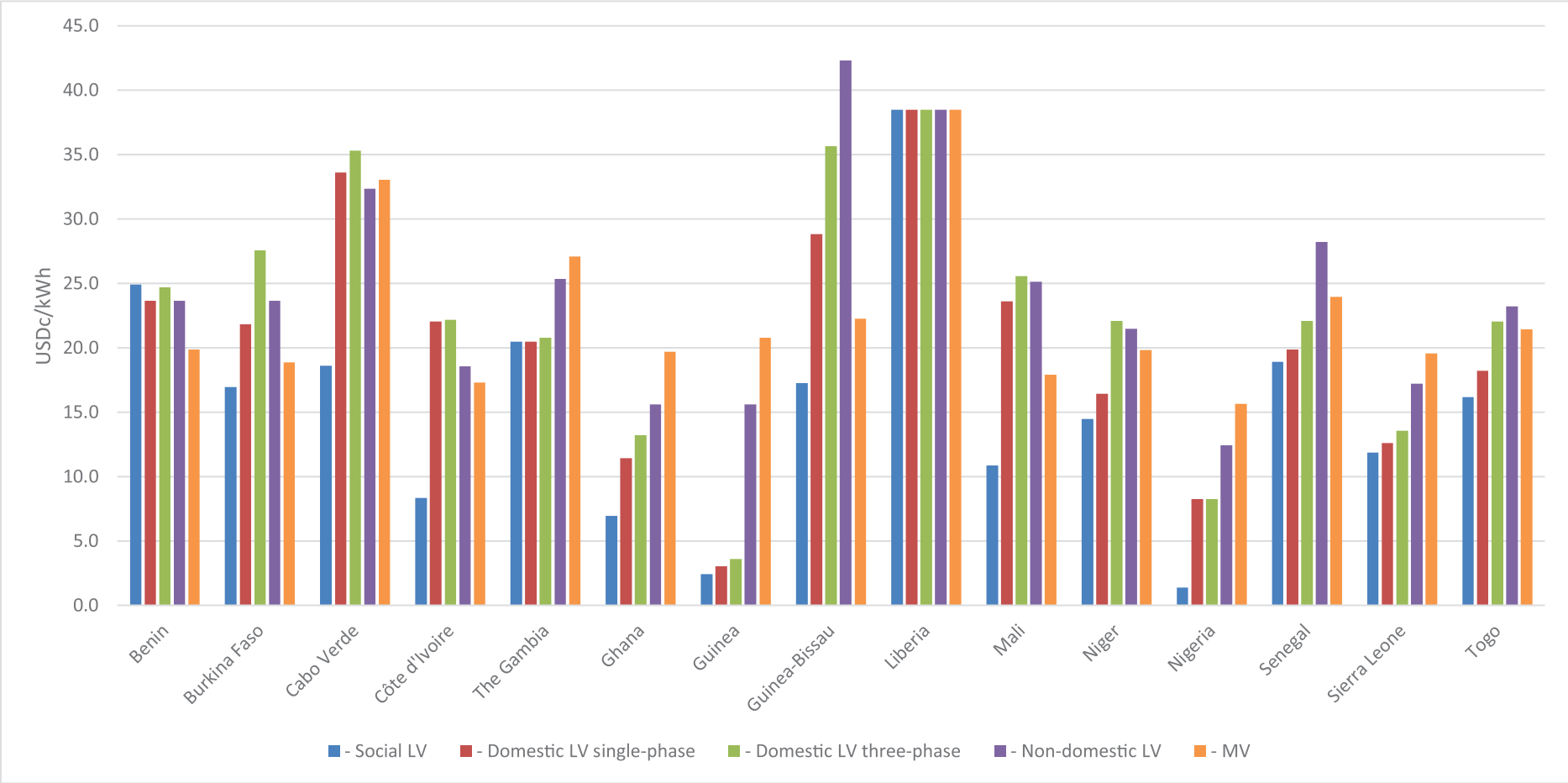
Source: Calculations from data collected by the authors

Table 24 - Electricity end-user tariff in US cents per kWh (without taxes and charges) as of 2018

	Description	kW	kWh	Benin	Burkina	Cabo Verde	Côte d'Ivo.	Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo	Median
				SBEE	SONABEL	ELECTRA	CIE	NAWEC	ECG	EDG	EAGB	LEC	EDM	NIGELEC	ABUJA	SENELEC	EDSA	CEET	
1.1	Social LV Consumer	1	50	20.7	13.0	27.2	7.2	20.5	6.6	2.1	17.3	35.0	10.7	12.9	1.3	15.7	10.3	16.2	13.0
2.1	Single phase Domestic LV Consumer	2	250	19.6	20.2	29.0	12.5	20.5	10.9	2.6	33.3	35.0	19.8	14.2	7.8	16.5	10.9	16.3	16.5
3.1	Three-phase Domestic LV Consumer	6	500	20.5	24.7	30.5	12.9	20.8	12.6	3.0	35.7	35.0	21.4	18.0	7.8	18.3	11.8	19.2	19.2
4.1	Non domestic LV Consumer	2	500	19.6	18.6	27.9	14.9	22.0	14.9	13.2	42.3	35.0	21.1	18.0	11.8	23.4	15.0	19.7	19.6
6.1	MV Consumers	250	40000	16.4	18.8	28.6	12.9	23.5	18.7	17.2	22.2	35.0	13.5	17.0	14.9	19.9	17.0	18.2	18.2

Source: Calculations from data collected by the autors

Figure 15 - Electricity end-user tariff in US cents per kWh (with taxes and charges) as of 2018



Note: taxes and charges of country are presented in Table 25

Source: Calculations from data collected by the authors

Figure 16 - Electricity end-user tariff in US cents per kWh (with taxes and charges) per standard consumer as of 2018

Source: Calculations from data collected by the authors

Table 25 – EUT taxes, levies and charges applicable

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Energy related															
VAT/GST*	18%*	18%*	15%*	18%	15%*	N/A	18%	No data available	10%	18%*	19%*	5%	18%	15%	18%
Rural Electrification	3 FCFA /kWh	2 FCFA		Ranges between 1 – 1.10 FCFA/kWh + 100 FCFA per bimester, 1.30 FCFA/kWh, and 1870 FCFA/kW/year		2%					1.2 FCFA/kWh				
Regulatin levy			0.75%							1% (embedded in tariffs)				1% (embedded in tariffs)	
Redevance		Ranges between 381 – 8538 FCFA											Ranges between 429 – 1427 FCFA		
Street light		4 FCFA				3%					0.8 FCFA/kWh				Ranges between 1-2 FCFA/kWh
Advance on consumption		Ranges between 3375 – 153900 FCFA, and up to 100*165 FCFA/kw								Ranges between 4590 – 121914 FCFA, and up to 11655 FCFA/kW					
Connection charges		Timbres range between 400 – 4000 FCFA, Liasses 108 FCFA (Rural exempt)													
Import charges															2 FCFA/kWh
Not related to energy															
Housing/City hall											Ranges between 200 – 6000 FCFA/kW		2.5%		
Police		Ranges between 691 – 1380 FCFA													
Waste collection				Ranges between 1-2.5 FCFA/kWh											
Radio/Television		2 FCFA		Ranges between 2 – 3 FCFA/kWh, 2000 FCFA per bimester, and 1000 FCFA per month							3 FCFA/kWh				

*At least one category or consumption block is exempt (See Table 27 – Subsidized categories)

Source: Data collected by the authors

Table 26 – EUT adjustment

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Frequency	Ad-hoc	No data available	Per semester	Ad-hoc	No adjustment	Quarterly	No data available	No data available	Ad-hoc	No data available	Per tariff cycle	Per tariff cycle	Per trimester	No data available	Ad-hoc
CPI	Y											Y	Y		Y
PPI											Y				Y
Exchange Rate	Y					Y					Y	Y	Y		Y
Fuel Cost	Y		Y			Y			Y		Y	Y	Y		Y
Other						Total cost; labour cost, depreciation			Political Intervention			US CPI, Generation capacity			IPP price, transport cost, OPEX, Revenues

Source: Data collected by the authors

Of the countries listed in the section on macroeconomic trends with the highest inflation, only Nigeria provides explicit allowance for CPI adjustment in ongoing tariff revisions, though the adjustments in Ghana indirectly reflect inflationary pressures through the exchange rate and adjustments for total costs.

E.2 Social and subsidised tariffs

The tables below present the tariff categories which are subsidized in each country. The most common subsidy mechanism is VAT/GST exemption, either for a specific consumption block, or to a category, used in Benin, Burkina Faso, Cote d'Ivoire, Gambia, Mali and Niger.

Another used mechanism is to have a separated social tariff, used in Cabo Verde and Nigeria, and in combination with VAT exemption as described above, in Cote d'Ivoire, Mali and Niger.

Table 27 – Subsidized categories

	Subsidized categories
Benin	Social block (0 to 20 kWh) is exempt of VAT (18%)
Burkina Faso	First 150 kWh consumed are exempt of VAT (18%)
Cabo Verde	Social tariff established by law in 2018, where the LV tariff is discounted by 30% for consumption of 0 to 30kWh, 20% for the band 31 to 60 kWh, 10% for the band 61 to 90 kWh, and 0% for consumption of 91 kWh and above. However, this is not yet implemented.
Côte d'Ivoire	Social tariff ("Domestique Social monophase BT") is exempt of VAT (18%) on the first consumption block (0 to 80 kWh), while the fixed charge is also exempt. Furthermore, these customers pay a lower RTI (2 FCFA/kWh, compared to 3 FCFA/kWh paid by general domestic prepayment customers). Employees of the electricity sector have a special tariff also ("Domestique Conventionnel BT")
The Gambia	Domestic category is exempt of VAT (15%). Furthermore, the first 300 kWh consumed is excempt from VAT.
Ghana	Residential lifeline consumers pay a lower fixed charge (213.0 GHp/month compared to 633.2 GHp/month paid by other residential consumers)
Guinea	First 40 kWh is exempt from VAT
Guinea-Bissau	Social tariff
Liberia	There are no subsidized categories
Mali	Social tariff ("BT – Tarif Social"). Block 1 (0 to 50 kWh) and block 2 (51 to 100 kWh) of BT Monophase 5A and Tarif Social are exempt of VAT (18%).
Niger	Social tariff for those consuming less than 50 kWh/month. Also, the first 150 kWh consumed are exempt of VAT (19%). Finally, MV Hydro Agriculture also has a special tariff
Nigeria	Social tariff for certain residential consumers consuming less than 50 kWh/month
Senegal	DPP block 0 to 150 kWh and DMP block 0 to 50 kWh are exempt of VAT.
Sierra Leone	The first 50 kWh consumed by the restidential category are considered asthe social tariff (cross-subsidy)
Togo	Three categories are cross-subsidized: Domestic with contracted demand lower or equal to 2.2 kVA, CEET employees, and Prepayment

Source: Data collected by the authors

There is limited information on the extent of cross-subsidy or any explicit Government support (over and above VAT exemptions) required to maintain social tariffs. Its evaluation would require country-by-country cost modelling including the consideration of broader cross-subsidies between residential and commercial/industrial customers. Later in this section simple analysis is undertaken on the share of tariffs borne by customer categories compared with energy volumes, which is indicative but does not reflect whether tariffs recover costs and how specific customer categories contribute to overall costs.

E.3 Key underlying drivers of EUT

To compare between categories across countries, the first consideration was to group the categories of each country into the following category groups:

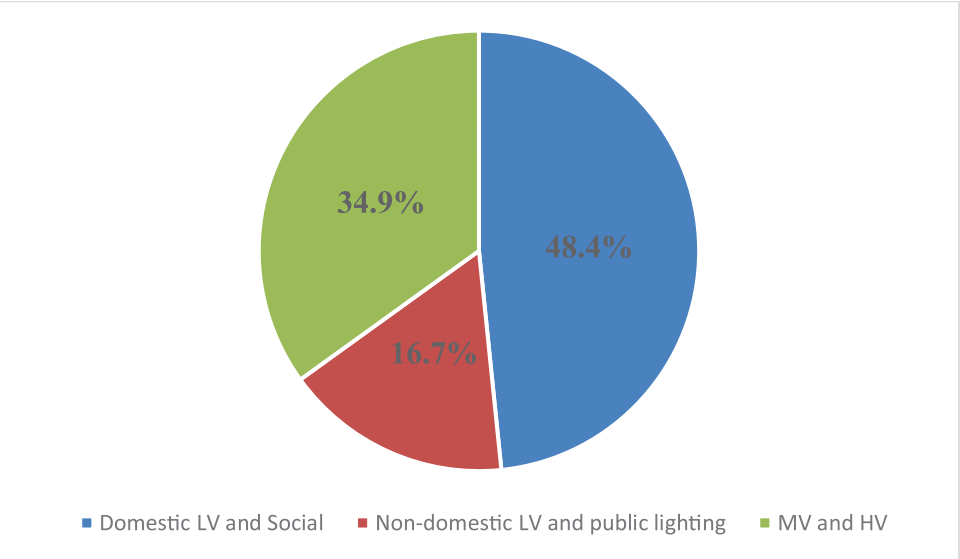
- Social
- Domestic LV
- Non-Domestic LV
- MV
- HV
- Street Lighting

The criteria followed is presented in greater detail in Table 51 in Annex I.

In the tables below, the number of clients, electricity distributed and revenue for each of the constructed category groups is presented.

As a summary of this exercise, the figure below presents the average share of each category group regarding electricity distributed. Given that for many countries it was not possible to estimate the share of Social and/or Public lighting due to lack of data (as portrayed in the tables further below), these categories were added to Domestic LV and Non-Domestic LV respectively.

Figure 17 – Electricity distributed per category group (% of total)



Source: Calculations based on Data Collection

As depicted in the figure above, the average ECOWAS member country distributed 48% of its electricity to Domestic LV and Social, 35% to MV and HV and 17% to Non-domestic LV and public lighting. Countries with a structure significantly different to this are on the one hand, countries where

Domestic and Social has a higher share than the above-mentioned average, such as Senegal 73%, Nigeria 61% and Mali 61%. On the other hand, countries where the share is smaller (and thus MV and HV have a higher share), include Guinea Bissau 12%, Benin 36% and Niger 38%.

Table 28 – Number of customers per category group

	Social	Domestic LV	Non-Domestic LV	MV	HV	Street Lighting	Total
Benin	N/A	604,167		977	N/A	Not available	605,144
Burkina Faso	N/A	662,699	1,656	1,855	1	1,394	667,605
Cabo Verde	N/A	171,067	856	211	N/A	Not available	172,134
Côte d'Ivoire	833,744	792,013	5,820	5,375	2	10,369	1,647,323
The Gambia	N/A	127,538	41,683	522	N/A	4,249	173,992
Ghana	Not available	3,013,488	510,700	454	99	137	3,524,878
Guinea	N/A	275,650	21,651	352	Not available	4,180	301,833
Guinea-Bissau	Not available	14,172	6,803	100,771	N/A	N/A	121,746
Liberia	N/A	60,829	24	387	N/A	189	61,429
Mali	Not available	504,674		2,226	N/A	Not available	506,900
Niger	89,599	251,878	79,555	1,422	N/A	Not available	422,454
Nigeria	275,854	9,253,639	1,737,930	73,223	6,365	4,762	11,351,773
Senegal	N/A	1,544,022	425,570	5,236	5	1,267	1,976,100
Sierra Leone	N/A	170,067	19,449	4,054	N/A	9	1935,79
Togo	N/A	297,487	29,281	608	N/A	1,083	328,459

Note: N/A is not aplicable

Source: Calculations based on data collected by the authors

Table 29 – Electricity distributed (GWh) per category group

	Social	Domestic LV	Non-Domestic LV	MV	HV	Street Light	Total
Benin	N/A	364.2	322	317	N/A	23	1,026.2
Burkina Faso	N/A	770.9	81.2	562.4	133.8	16.1	1,564.3
Cabo Verde	N/A	141.2	33.6	118.2	N/A	14.8	307.8
Côte d'Ivoire	382.2	2,709.4	32.2	3,070.2	49.5	403.1	6,646.6
The Gambia	N/A	157.4	50.8	56.3	N/A	9.1	274
Ghana	N /A	4,285.6	1,329.6	1,302.0	765.7	568.6	8,251.5
Guinea	Not available						1,117.0
Guinea-Bissau	N/A	14.2	6.8	100.8	N/A		121.8
Liberia	N/A	41.2	5.9	12.9	N/A	10.8	70.7
Mali	247.6	643.8	14.3	544.2	N/A	23.1	1,473
Niger	N/A	347.0	356.1	211.1	N/A	N/A	914.1
Nigeria	523	30,869	5733	5,342	8,477	401	51,345
Senegal	N/A	2,724.6	459.0	241.3	200.0	85.6	3,710.5
Sierra Leone	N/A	141.1	27	6.5	81.5	0.03	256.1
Togo	N/A	405.4	216.1	331.9	N/A	16.5	969.9

Note: N/A is not aplicable

Source: Calculations based on data collected by the authors

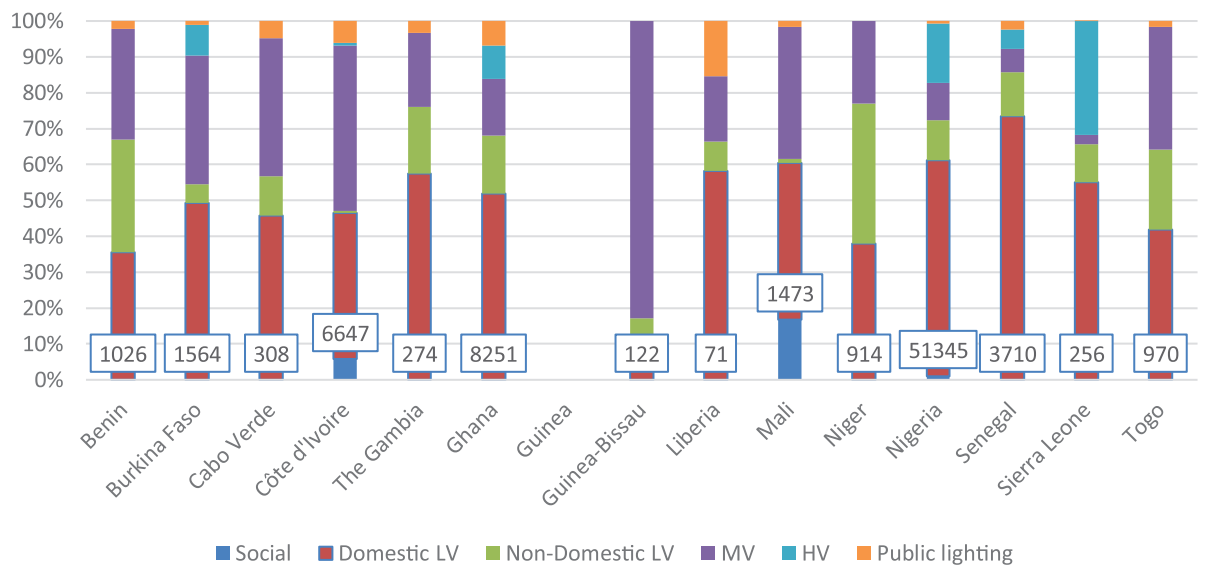
Table 30 – Revenue (USD thousand) per category group

	Social	Domestic LV	Non-Domestic LV	MV	HV	Street Light	Total
Benin	Not available						179842.1
Burkina Faso	Not available						307,448.5
Cabo Verde	N/A	40,930.3	9,960.5	27,079.8	N/A	3,479.2	81,449.8
Côte d'Ivoire	40,288.6	304,097.1	187,342.3	428,199.8	6,486.6	61,780.2	1,028,195.0
The Gambia		31952.3	12409.05	13561.03		2142.28	60064.67
Ghana		537,979.3	237,959.3	201,895.2	91,499.3	0	1,069,333.0
Guinea	Not available						93,375.7
Guinea-Bissau	Not available						22,203.1
Liberia	N/A	14,400.0	2,050.0	4,510.0	N/A	3,790.0	24,750.0
Mali	39,766.0	73,878.9	2,723.4	74,112.6	N/A	4,052.0	194,532.9
Niger	N/A	51,503.9	72,246.1	36,116.6	N/A	Not available	159,865.6
Nigeria	4,978.8	1,532,095.0	327,928.2	426,613.4	615,938.0	29,161.5	2,936,715.0
Senegal	N/A	466,781.5	110,316.9	54,239.1	28,763.4	18,081.4	678,182.3
Sierra Leone	N/A	20,792.0	4,618.0	1,051.0	14,885.0	-	41,346.0
Togo	N/A	79,202.6	53,272.5	66,488.4	N/A	5,023.3	203,986.8

Note: N/A is not aplicable

Source: Calculations based on data collected by the authors

Figure 18 - Electricity distributed (GWh) per category group



Source: Calculations based on data collected by the authors

Considering the above portrayed revenues and electricity distributed, the average tariff per category group is calculated, as shown below:

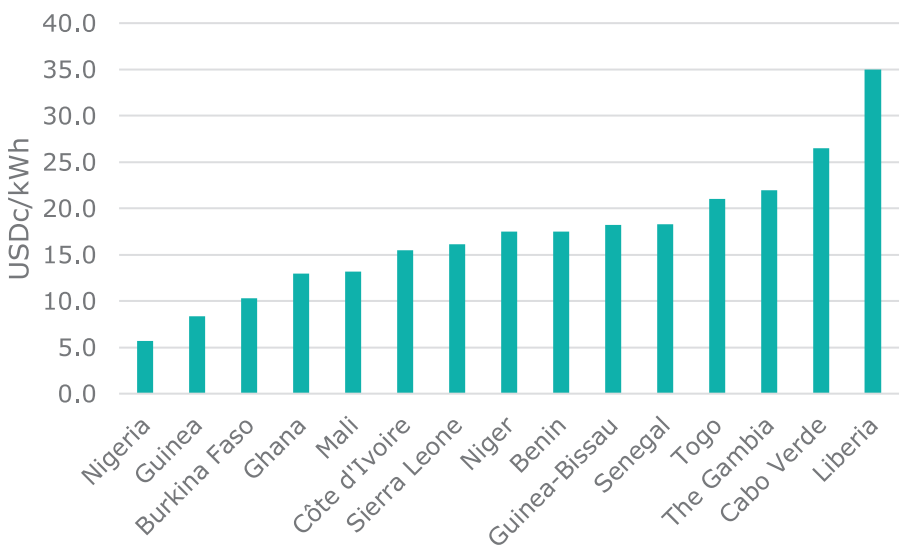
Table 31 – Average EUT (USDc/kWh) per customer group

	Social	Domestic LV	Non-Domestic LV	MV	HV	Street Light	Total
Benin	Not available						17.5
Burkina Faso	Not available						19.7
Cabo Verde	N/A	29.0	29.6	22.9	N/A	23.4	26.5
Côte d'Ivoire	10.5	11.2		13.9	13.1	15.3	15.5
The Gambia	N/A	20.3	24.4	24.1	N/A	23.5	21.9
Ghana	Not available	12.6	17.9	15.5	12.0	Not available	13.0
Guinea	Not available						8.4
Guinea-Bissau	Not available						18.2
Liberia	N/A	35.0	35.0	35.0	N/A	35.0	35.0
Mali	16.1	11.5	19.0	13.6	N/A	17.5	13.2
Niger	Not available	14.8	20.3	17.1	N/A	Not available	17.5
Nigeria	1.0	5.0	5.7	8.0	7.3	7.3	5.7
Senegal	N/A	17.1	24.0	22.5	14.4	21.1	18.3
Sierra Leone	N/A	14.7	17.1	16.2	18.3	Not available	16.1
Togo	N/A	19.5	24.7	20.0	N/A	30.4	21.0
Median							17.5

Note: N/A is not aplicable

Source: Data collected by the authors

Figure 19 – Average EUT (USDc/kWh)



Source: Data collected by the authors

The table below provides an estimate of the contribution of each segment in the EUT (% of EUT), as reported by the focal point, or as best estimated by the authors. Based on the available data, generation has the highest share in the EUT in all countries, ranging between 52% and 85%.

Table 32 – Contribution of each segment in the EUT (% of EUT)

	Generation	Transmission	Distribution
Benin	52%	19%	29%
Burkina Faso	Not available		
Cabo Verde	62%	9%	29%
Côte d'Ivoire	81%	6%	13%
The Gambia	Not available		
Ghana	55%	6%	39%
Guinea*	81%	4%	15%
Guinea-Bissau	66%	8%	26%
Liberia	52%	19%	29%
Mali	85%	8%	7%
Niger	62%	38%	
Nigeria	50%	15%	35%
Senegal	Not available		
Sierra Leone	Not available		
Togo*	Not available		

*As of 2016

Source: Calculations based on data collected by the authors

As a high level means to evaluate possible cross-subsidies, a comparison is made between the share of revenue and the share of energy by each customer group.

Table 33 – Difference between customer category share in revenue and energy volumes per category group

	Social	Domestic LV	Non-Domestic LV	MV	HV	Street Light
Benin	Not available					
Burkina Faso	Not available					
Cabo Verde	NA	4.4%	1.3%	-5.2%	NA	-0.5%
Côte d'Ivoire	-1.8%	-11.2%	17.7%	-4.5%	-0.1%	-0.1%
The Gambia	N/A	-4.2%	2.1%	2.0%	N/A	0.2%
Ghana	NA	-1.6%	6.1%	3.1%	-0.7%	-6.9%
Guinea	Not available					
Guinea-Bissau	Not available					
Liberia	NA	-0.1%	-0.1%	0.0%	NA	0.0%
Mali	3.6%	-5.7%	0.4%	1.2%	NA	0.5%
Niger	NA	-5.7%	6.2%	-0.5%	NA	NA
Nigeria	-0.8%	-8.0%	0.0%	4.1%	4.5%	0.2%
Senegal	NA	-4.6%	3.9%	1.5%	-1.1%	0.4%
Sierra Leone	NA	-4.8%	0.6%	0.0%	4.2%	NA
Togo	NA	-3.0%	3.8%	-1.6%	NA	0.8%

Note: N/A is not aplicable

Source: Calculations based on data collected by the authors

The data generally suggests that a lower than proportionate share of revenue is recovered from Domestic LV customers (and social customers), while in most cases Non-Domestic LV Customers

and MV customers account for a higher share of revenues than implied by energy volumes alone. The picture for HV customers is mixed, a lower share of costs may be justified by not requiring use of the MV and LV networks. However, in two countries, a greater proportional cost share is borne by HV customers.

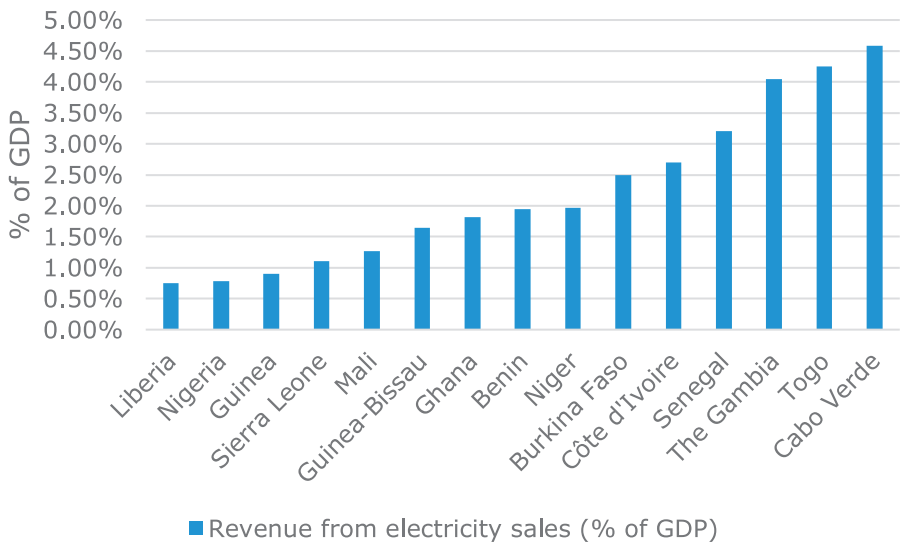
An estimate of electricity sales as a percentage of GDP is set out in the table and figure below. The indicator ranges between 0.75% in Liberia to 4.59% in Cabo Verde.

Table 34 - Revenue from electricity (% of GDP)

	Revenue from electricity sales (USD million)	GDP (USD billion current)	Revenue from electricity sales (% of GDP)
Liberia	24.8	3.284	0.75%
Nigeria	2,936.7	376.361	0.78%
Guinea	93.4	10.401	0.90%
Sierra Leone	41.3	3.748	1.10%
Mali	194.5	15.366	1.27%
Guinea-Bissau	22.2	1.35	1.64%
Ghana	1,069.3	58.978	1.81%
Benin	179.8	9.265	1.94%
Niger	159.9	8.136	1.96%
Burkina Faso	307.4	12.349	2.49%
Côte d'Ivoire	1,028.2	38.13	2.70%
Senegal	678.2	21.135	3.21%
The Gambia	52.7	1.483	4.05%
Togo	204.0	4.795	4.25%
Cabo Verde	81.4	1.776	4.59%

Source: IMF and data collected by the authors

Figure 20 - Revenue from electricity (% of GDP)



Source: IMF and data collected by the authors

Furthermore, the table below provides an estimate of the average expenditure on electricity as a percentage of household income. This analysis considers average monthly income/expenditure multiplied by average number of members per household as a proxy for average household income. Cote d'Ivoire and Liberia are the countries where the largest share of household income is estimated to be spent on electricity, at 5.1% and 4.8% respectively.

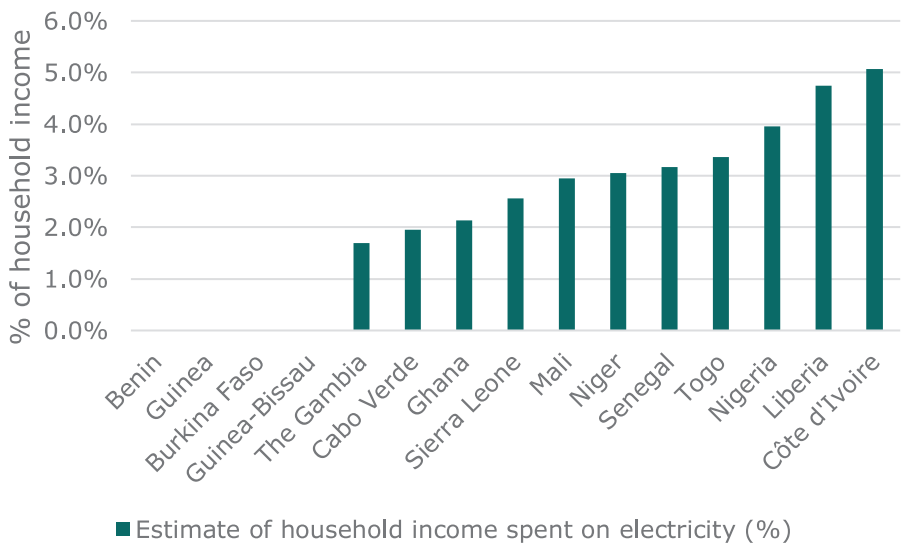
Table 35 - Estimate of household income spent on electricity

	Revenue from Domestic LV (USD thousand)	Number of Domestic LV clients	Revenue per domestic LV client (USD)	Per capita Income (USD/year)	Year of per capita income	Number of members per household	Household income (USD/year)	Estimate of household income spent on electricity (%)
Benin	Not available	604167.0	Not available	991.3	2015	5.0	4956.6	Not available
Guinea	Not available	275650.0	Not available	1047.6	2012	7.2	7542.7	Not available
Burkina Faso	Not available	326748.0	Not available	1006.1	2014	5.7	5734.7	Not available
Guinea-Bissau	Not available	14172.0	Not available	830.2	2010	Not available	Not available	Not available
The Gambia	31952.3	127537.8	250.5	1798.9	2015	8.2	14751.1	1.7%
Cabo Verde	40930.3	171067.0	239.3	2920.1	2007	4.2	12264.3	2.0%
Ghana	537979.3	3013488.0	178.5	2394.6	2016	3.5	8381.1	2.1%
Sierra Leone	20792.0	170067.0	122.3	851.8	2011	5.6	4769.9	2.6%
Mali	73878.9	504674.0	146.4	871.3	2009	5.7	4966.5	2.9%
Niger	51503.0	251878.0	204.5	944.4	2014	7.1	6705.2	3.0%
Senegal	466781.5	1544022.0	302.3	1151.8	2011	8.3	9559.6	3.2%
Togo	79202.6	297486.6	266.2	990.2	2015	8.0*	7921.9	3.4%
Nigeria	1532094.6	9253639.0	165.6	910.3	2009	4.6	4187.5	4.0%
Liberia	14400.0	60829.0	236.7	996.7	2016	5.0	4983.6	4.8%
Côte d'Ivoire	304097.1	792013.0	384.0	1403.2	2015	5.4	7577.1	5.1%

*Local source

Source: Calculations based on AFDB data and data collected by the authors

Figure 21 - Estimate of household income spent on electricity



Source: Calculations based on UN data and data collected by the authors

Various operational and service performance indicators have been collated.

The table below provides reported data on collection rates (collection / billed electricity) included in the tariff. Of the countries with data available, Nigeria and Guinea present the lowest levels of collection, 66% and 70% respectively.[21]

Table 36 - Collection rate

	Collection rate (%)
Cabo Verde	No data available
Nigeria	**66.0%**
Guinea	**70.0%**
Guinea-Bissau	**81.0%**
Liberia	**82.0%**
Ghana	**86.8%**
Sierra Leone	**88.0%**
Senegal	**88.9%**
Benin	**91.2%**
Burkina Faso	**91.2%**
The Gambia	**94.0%**
Togo	**94.4%**
Côte d'Ivoire	**96.1%**
Mali	**98.0%**
Niger	**98.0%**

Source: Data Collection

Data on the physical nature of the distribution network and its performance has been reviewed to consider their role as key cost drivers.

Analogous to transmission, distribution is defined differently across the region. The table below summarizes injection levels of distribution in each country:

Table 37 – Injection level of Distribution

	33- 15 kV	11-6 kV	0.4 – 0.22 kV
Benin	15		0.4
Burkina Faso	33		
Cabo Verde	20		
Côte d'Ivoire	15		
The Gambia*			0.4
Ghana*	33	11	0.4
Guinea*	No data available		
Guinea-Bissau		10 & 6	0.22
Liberia	33		
Mali	30	6.6	
Niger	20		
Nigeria	33		
Senegal	30		0.4
Sierra Leone	No data available		
Togo		11	

*Assumption of authors based on voltage of transmission network

Source: Data collected by the authors

The table below provides the length of the distribution network length for each country.

21 The data for Nigeria is referenced as collection efficiency, which may incorporate some element of non-technical losses.

Table 38 – Distribution Network length

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Network length (km) - Distribution	**6,512**	**17,889**	**3,648**	**46,185**	**980**	**137,659**	**1,230**	**No data available**	**No data available**	**8,760**	**6,262**	**224,623**	**21,890**	**5,534**	**9,120**
- 66 kV															75
- 33 kV						20,000					247	63,285			555
- 30 kV													12,108		
- 20 kV			1,685								1,939				2,994
- 15 kV				24,534											
- 11 kV						20,496						39,291			
- 0.4 kV			1,963	21,651	980	68,018					4,076	122,047			5,496
- 0.380 kV													9,782		

Source: Data collected by the authors

To evalulate if there is strong evidence of economies of scale, empirical analysis developing a Composite Scale Variable (CSV) has been undertaken. The analysis, which is set out in Annex IV implies the presence of comparative economies of scale in Burkina Faso, Cote d'Ivoire, Ghana, Nigeria and Togo. This implies costs per client are expected to be lower there. However, the differences highlighted between countries are not highly significant.

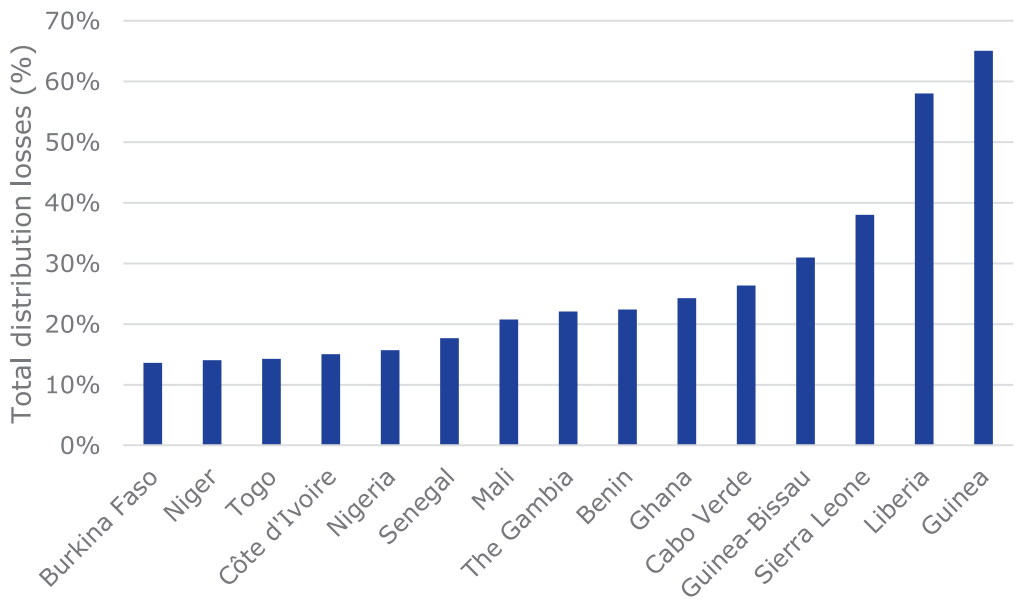
The table below portrays reported total distribution losses, where possible those included in tariff setting and disaggregated between technical and non-technical losses. The subsequent figure graphically depicts countries by total losses. The highest reported values are in Guinea and Liberia.

Table 39 – Distribution losses

	Technical losses (% of total)	Non-technical losses (% of total)	Total losses (% of injected electricity)
Benin	No data available		22.4%
Burkina Faso	No data available		13.6%
Cabo Verde	No data available		26.3%
Côte d'Ivoire	No data available		15.0%
The Gambia	14.0%	8.0%	22.0%
Ghana	10.6%	13.8%	24.3%
Guinea	No data available		65.0%
Guinea-Bissau	No data available		31.0%
Liberia	12.0%	46.0%	58.0%
Mali			20.7%
Niger	No data available		24.6%
Nigeria	6.1%	9.6%	15.7%
Senegal	No data available		17.7%
Sierra Leone	No data available		38.0%
Togo	4.3%	10.0%	14.3%

Source: Data collected by the authors

Figure 22 – Total distribution losses



Sources: Data collected by the authors

Two typical efficiency indicators were considered: SAIDI (average total duration of outages - in hours - experienced by a customer in a year) and SAIFI (average number of service interruptions experienced by a customer in a year). These are presented in the table below.

Table 40 – SAIDI and SAIFI

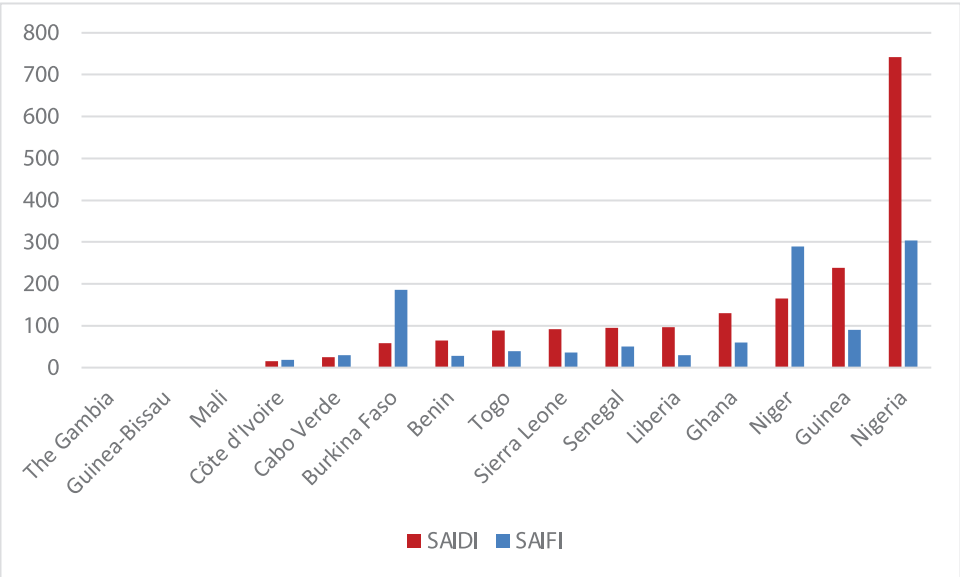
	SAIDI	SAIFI
Benin	65	28
Burkina Faso	59	186
Cabo Verde	24	30
Côte d'Ivoire	15	19
The Gambia	No data available	
Ghana	130	60
Guinea	238	91
Guinea-Bissau	No data available	
Liberia	96	29
Mali	No data available	
Niger	165	289
Nigeria*	742	304
Senegal	95	50.4
Sierra Leone	10	3
Togo	89	39

*Kano

Source: WBG and data collected by the authors

The figure below provides the same indicators in graphical form, sorted by increasing SAIDI (red bars). For the countries where data is available, Nigeria, Niger and Guinea are the countries with more and longer interruptions per customer on average.

Figure 23 – SAIDI and SAIFI



Source: WBG and data collected by the authors

High distribution losses and poor performance related to SAIFI and SAIDI suggest that tariffs may need to be raised to allow the utility to invest in network reinforcement and loss reduction and introduce more advanced management and operational practices. However, at the same time, it is socially difficult to raise tariffs when performance is sub-standard, creating a dilemma for the utility and the regulator.

Summary findings – EUT

- The use of block tariffs for residential customers is common
- However, there is a wide variation in how block tariffs are applied – with the difference between the largest and smallest tariff block ranging between -13% and more than +200%
- 11 of the countries apply either a fixed monthly charge or a fixed capacity charge to residential customers.
- Based on the development of standard customer profiles, there is a large variation in tariffs across the region, which broadly reflects the difference in generation costs.
- The application of social tariff blocks or VAT exemptions are the most common methods for subsidising certain customer groups
- The significance of the electricity bill on household income varies across countries (other things being equal), rising to up to 5.1% of average income
- There is some evidence of comparative economies of scale in distribution, which should affect the opex per customer
- Poor service quality is reported in some countries. This may suggest that tariffs need to be increased to promote the necessary investment. However, poor service quality also creates difficulties in justifying tariff increases

CHAPTER V.

CONCLUSIONS AND LESSONS LEARNT

A key finding from this study is that there is a no one-size-fits all approach to tariff setting: several different industry structures are apparent, with many regulatory approaches applied. Some common trends arise, however, with strong support for IPPs in all countries, movements towards greater structural separation and a strong reliance on pricing approaches that involve review of underlying cost drivers. The fact that IPPs have been facilitated across all countries suggests the presence of flexibility in the face of evolving needs.

Another key feature is the importance of regional trade across many countries, which can be seen in the development of cross-border institutions, such as the Société de Gestion de l' Energie de Manantali (SOGEM), which supports electricity demand in three of the member countries considered. The extension of access to transmission networks across the region through the implementation of the ERERA Directive is both a consequence of this need and an ongoing requirement in other members to promote the key benefits that trade can provide. However, for key benefits of this trend to be realized, greater progress in the development of cross-border transmission tariffs and understanding cost differences in generation appears necessary.

End user tariffs differ significantly across the region, with a key factor being the difference in the cost of generation. Key attributing factors to the differences include the importance of hydro, and the type and efficiency of thermal generation. However, greater understanding of costs is required to help evaluate further these differences and consider the role that other technologies (like solar PV and wind) can play to reduce costs and tariff pressures.

The use of social tariffs is a well-established practice to protect lower income customers. However, such measures create a need for cross-subsidies. Evaluating the extent of these cross subsidies requires detailed modelling of the cost burden of different customer groups. However, ensuring that any cost shortfall is made up from other customers (or directly from Government), with the burden being spread appropriately across other customers is a critical factor in tariff sustainability. Several other factors suggest that sustainability is a problem in some countries – for example, poor collection rates, high losses and poor quality of service indicators.

A key challenge in preparing this report has been to obtain relevant information, such as on generation and transmission costs, capital and operating expenditure, transmission and distribution losses, collection rates and revenue breakdown by customer category. Hence, it is important that actions are undertaken to facilitate collection of information, where the Focal Points appear best placed to take a lead role in the process. Providing regular reports will also enhance the quality of information received and allow for better identification of trends over time.

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ANNEX I. TABLES

This annex includes relevant tables providing detailed data used in the body of the report for the comparative study.

Table 41 – Summary of Comparative Analysis

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Unbundling Regime[23]	No unbundling	No unbundling	Incomplete unbundling - legal	Incomplete unbundling - accounting	No unbundling	Complete unbundling - ownership	No unbundling	No unbundling	No unbundling	No unbundling	Incomplete unbundling - accounting	Complete unbundling - ownership	Incomplete unbundling - functional	Complete unbundling - ownership	No unbundling
Bulk Generation Tariff (USD/MWh)	131.5	87.1	143.4	37.5	120.0	89.2	142.2	102.4	26.1	75.7	153.1	66.0	144.4	100.0	83.1
Transmission Tariff (USD/MWh)	17.4	No data available	24.2	9.3	No data available	8.7	3.7	14.9	66.5	10.4	No data available	12.8	No data available	No data available	17.4
Average End User Tariff (USDc/kWh)	17.5	10.3	26.5	15.5	21.9	13.0	8.4	18.2	35.0	13.2	17.5	5.7	18.3	16.1	21.0
Single phase domestic LV consumer[24]	23.7	21.8	33.6	22.0	20.5	11.4	3.0	28.8	38.5	23.6	16.4	8.2	19.9	12.6	18.2

Source: Data Collected by the authors

[23] The categories considered are:
- No unbundling - unified ownership; both network and generation activities continue to be owned and managed by the same company
- Incomplete unbundling - accounting: separate accounts must be kept for the network activities and generation activities to prevent cross subsidization
- Incomplete unbundling - functional: also called management unbundling, requires, in addition to keeping separate accounts, that the operational activities and management are separated for transmission and generation activities.
- Incomplete unbundling - legal: requires that transmission and generation be put in separate legal entities
- Complete unbundling - ownership: Generation and transmission have to be owned by independent entities. These entities are not allowed to hold shares in both activities.

[24] With 2kW subscribed demand and 250 kWh monthly consumption (price of each kWh on average in USDc, including taxes and applicable charges).

Table 42 - Macroeconomic Indicators (values as of 2018 unless otherwise stated)

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
GDP (current USD billion)1	10.0	13.7	1.9	41.5	1.6	62.1	12.1	1.4	3.2	16.6	8.9	421.2	23.2	3.8	5.1
GDP per capita (current PPP int.dollars)2	2,426	1,996	7,316	4,178	2,792	6,452	2,310	1,937	1,418	2,384	1,217	6,027	3,651	1,620	1,746
Exchange rate (LCU per USD, period average) 3	576	576	96	576	49	5	9,085	576	158	576	576	307	576	8,396	576
Inflation, consumer prices (average annual %)4	1.0	2.0	1.3	0.3	6.5	9.8	9.7	1.4	23.4	1.7	3.0	12.1	0.5	16.9	0.7
Profit tax (% of commercial profits)5	10	16	19	9	6	18	0	15	35	10	22	21	16	19	10
Population (million, total in the country) 6	11	20	1	26	2	30	13	2	5	19	19	194	16	8	8
Land Area (total sq.km. in the country) 7	114760	274200	4030	322000	11300	227540	245860	36130	111300	1240190	1267000	910770	192530	72300	56790
Access to electricity (% of population) 8 *	43.1	25.5	92.9	65.6	56.2	79.0	35.4	26.0	21.5	44.0**	13.0**	54.4	61.7	23.4	48.0

*As of 2017
**As of 2018

Sources: 1) IMF, 2) IMF, 3) Central Banks, 4) IMF, 5) WBG, 6) WBG, 7) WBG, 8) WBG for 2017 values and local souces for 2017 and 2018

Table 43 – Market Structure as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Structure level (1 to 5)	4	2	2	3	2	5	2	2	3	3	3	5	3	4	4
Regime	No unbundling	No unbundling	Incomplete unbundling - legal	Incomplete unbundling - accounting	No unbundling	Complete unbundling - ownership	No unbundling	No unbundling	No unbundling	No unbundling	Incomplete unbundling - accounting	Complete unbundling - ownership	Incomplete unbundling - functional	Complete unbundling - ownership	No unbundling
Number of operators															
- Generation	1	2	5	5	2	13	5	1	1	3	3	15+	10	2	4
- Transmission	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
- Distribution	1	1	2	1	1	3	1	1	1	1	1	12	6	1	1
Open access to transmission network	Y	Y	Y	N	N	Y	N	N	Y	Y	Y	Y	N	Y	Y

Source: Data Collected by the authors

Table 44 – Tariff Methodology to calculate Revenue Requirement as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Methodology to calculate RR - Transmission	Cost Plus	Revenue Cap	Price Cap	Cost Plus	Cost Plus	Hybrid	Cost plus	Cost plus	Cost Plus	Cost Plus	Price Cap	Hybrid	Price Cap	Cost Plus	Revenue Cap
Methodology to calculate RR - Distribution	Cost Plus	Revenue Cap	Price Cap	Cost Plus	Cost Plus	Hybrid	Cost plus	Cost plus	Cost Plus	Cost Plus	Price Cap	Hybrid	Price Cap	Cost Plus	Revenue Cap
Tariff cycle (number of years)	3	5	5	1	1	5	5	No data available	3	5	5	15	3	1	No data available
Number of changes in tariff regime/methodology in the past 10 years	0	1	0	0	1	1	2	No data available	0	0	2	0	0	1	No data available
Number tariff related studies in the past 10 years	2	0	0	1	0	2	2	At least 1	1	2	1	0	0	1	No data available

Source: Data Collected by the authors

Table 45 – Generation mix (grid system) as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau**	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Capacity (MW)	219*	354	183	2189	113	4770	563	35	126	444	155	13651	1181	183	231
- Thermal (%)	100.0%	81.1%	83.5%	59.8%	100.0%	66.4%	34.7%	28.6%	30.2%	58.6%	100.0%	85.8%	81.5%	66.8%	71.2%
- Hydro (%)	0.0%	9.0%	0.0%	40.2%	0.0%	33.1%	65.3%	0.0%	69.8%	41.4%	0.0%	14.2%	6.3%	33.2%	28.8%
- Renewables (%)	0.0%	9.8%	16.5%	0.0%	0.0%	0.5%	0.0%	71.4%	0.0%	0.0%	0.0%	0.0%	12.1%	0.0%	0.0%
Electricity Production (GWh)	20	1021	427	9990	828	15818	1732	126	201	1457	200	31686	3838	333	592
- Thermal (%)	100.0%	85.7%	79.1%	70.3%	100.0%	62.0%	30.1%	87.2%	9.6%	47.8%	100.0%	75.7%	86.0%	21.6%	66.8%
- Hydro (%)	0.0%	9.0%	0.0%	29.7%	0.0%	38.0%	69.9%	0.0%	90.4%	52.2%	0.0%	24.3%	8.4%	78.4%	33.2%
- Renewables (%)	0.0%	5.3%	20.9%	0.0%	0.0%	0.0%	0.0%	12.8%	0.0%	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%

*Estimate by consultant based on SBEE annual report 2018

Source: Data collected by the authors

Table 46 – Isolated generation (off-grid systems) as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria *	Senegal	Sierra Leone	Togo
Capacity (MW)	No data available	**2.1**	No data available	**6.7**	No data available	No data availabl e	No data available	No data availabl e	**4.7**	**96.4**	**52.4**	**11**	**67.9**	No data availabl e	**15.4**
- Natural Gas (%)												100%			
- Diesel (%)		100.0%								79.0%	29.4%		58.9%		100.0%
- HFO/LFO (%)													41.1%		
- Coal (%)											70.6%				
- Biomass (%)									2.1%						
- Hydro (%)									91.5%						
- Solar (%)									6.4%						
- Wind (%)															
- Other (%)				100.0%					30.0%	21.0%					
Electricity Production (GWh)		**3.8**		**7.4**					**28.0**	**175.1**	**262.3**		**199.9**		**9.2**
- Natural Gas (%)															
- Diesel (%)		100.0%								86.4%	18.1%		42.0%		100.0%
- HFO/LFO (%)													58.0%		
- Coal (%)											81.9%				
- Biomass (%)									0.2%						
- Hydro (%)									91.4%						
- Solar (%)									0.2%						
- Wind (%)															
- Other (%)				100.0%					7.1%	13.6%					

*Plus Sabon Gari Market Kano which is Solar, for which there is no information available

Note: isolated generation is generally considered in the revenue requirement in these countries

Source: Data collected by the authors

Table 47 - Key underlying drivers of BGT as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Weighted Average Heat rate (BTU/kWh)	13739.2	9032.956	9170.353	9183.4502	No data available	8656.9298	No data available	No data available	No data available	No data available	No data available	No data available	9021.53511	No data available	7567.620777
CAPEX (USD/kW)															
- Natural Gas – OCGT				707.8											
- Natural Gas – CCGT															
- Diesel															
- HFO									1439.3						
- Coal															
- Biomass															
- Hydro				1743					2870.0						
- Solar															
- Wind															
- Other															
Average fuel cost (% of total generation costs)	96.1%			56.1%		32.1%			71.7%	69.1%	43.9%	69.1%	86.2%		81%
Average other variable costs (% of total generation costs)	3.9%			43.9%		67.9%			41.8%	30.5%	56.1%	23.4%	13.8%		19%
Average fixed costs (% of total generation costs)									22.4%	27.7%		7.5%			
Reserve margin (% of peak demand)				36%							0%	5%			10%
System peak demand (MW)	222	326	74.1	1388	70	2371	340	38	22.17	353	154	16660	642	125	231
Fuel/Source used to supply the peak	HFO			Natural Gas - CCGT					Hydro		Diesel		Diesel		Diesel
Weighted Average availability factor (%)			78.9%	74%	72.1%	84.6%				85.0%	100%	99.2%	81%		96.8%
Weighted average capacity factor (%)		65%		60%		33.3%				43.3%	80.0%		64.5%		56.9%
Climatic/Social conditions (Y/N)				No					Yes			Yes			

Source: Data collected by the authors

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
1)	BT1	A	BTN Mono 10A	Domestique Social mono. BT	Domestic	Residential - Lifeline consumers	BT domestique privé mono.	Tariff LV normal	Residential	BT – Prep.Mono.5 A	BT - Eclairage Public	R1	DPP	T1 Residential	D. <= 2.2 kVA
2)	BT2	B1	BTN Mono 15A	Domestique Général BT	Commercial	Residential - Other residential consumers	BT domestique privé triphasé	Tariff LV social	Commercial	BT – Prep.Mono.10 A	BT - Social	R2	DMP	T2 Commercial	D. > 2.2 kVA and < 13.2
3)	BT3	B2	BTN Tri 10A	Professionnel BT	Hotel/Club/ Industries	Non-residential	BT professionnels , commerce et industries mono.	Tariff LV businesses and commercial	Governmen t	BT – Prep.Mono.15 A	BT - Général Domestique 3kW	R3	PPP	T3 Institutions	D. >= 13.2 kVA
4)	M1A	B3	BTN Tri 15A	Domestique Conventionne l BT	Agriculture	SLT-LV	BT professionnels , commerce et industries tri.	Tariff MV	NGO	BT – Prep.Mono.20 A	BT - Général 6kW	R4	PMP	T4 Industries	Tarifs Agents CEET et Assimilés
5)	M1B	B4	BTE Mono 10A	Eclairage Public	Area Councils	SLT-MV	MT et HT professionnels , commerce et industries		Public Corporation	BT BT – Prep.Mono.25 A	BT - Général 12kW	C1	DGP	T5 Street Lighting	Non-Domestique
6)	M1C	B5	BTE Mono 15A	Domestique Social mono. BT – prep.	Central Government	SLT-HV	BT Institutions internationale s, ambassades et ONG mono.		Tax Exampt	BT – Prep.Mono.30 A	BT - Général 18kW	C2	PGP	T6 Temporary Supply	Eclairage Public
7)	M1D	B6	BTE Tri 10A	Domestique Général mono. BT – prep.	Domestic - Prepayment	SLT-HV MINES	BT institutions internationale s, ambassades et ONG tri.		LEC	BT – Prép. Mono. 35A	BT - Général 30kW	C3	TCU	T7 Welders	Compteur a Prep.
8)	M1E	C1	BTE Tri 15A	Domestique Général tri. BT – prep.	Commercial - Prepayment	Street Lighting	MT institutions internationale s, ambassades et ONG			BT – Prép.Mono. 40A	MT - General	D1	TG		MT <= 500 kVA
9)		C2	IP Mono 10A	Professionnel General mono. BT – prep.	Hotel/Club/In dustries - Prepayment		BT, MT et HT de l'administratio n			BT – Prép. Mono. 45A	MT - Aménagemen ts Hydro Agricoles	D2	TLU		MT > 500 kVA <= 1000 kVA
10)		C3	IP Mono 15A	Professionnel General Triphase BT – prep.	Agriculture - Prepayment					BT – Prép. Mono. 50A		D3	Concessionna ire d'électrificatio n rurale		MT > 1000 kVA <= 2500 kVA
11)		C4	IP Tri 10A	Courte utilisation MT	Councils/Gov ernment - Prepayment					BT – Prép. Mono. 55A		A1	Eclairage Public		MT > 2500 kVA <= 5000 kVA
12)		C5	IP Tri 15A	Générale utilisation MT						BT – Prép. Mono. 60A		A2	HT Général		Free Zone Tariff
13)		D1	MT	Longue utilisation MT						BT – Prép. Tri.10A		A3	HT Secours		Concession CEET - BT
14)		D2	CIPA	HT						BT – Prép. Tri.15A		S1	DPP-Prépaiement		Concession CEET - MT
15)		E1								BT – Prép. Tri.20A			DMP-Prépaiement		MT > 5000 kVA <= 7500 kVA
16)		E2								BT – Prép. Tri.25A			PPP-Prépaiement		
17)		G								BT – Prép. Tri. 30A			PMP-Prépaiement		
18)		F1								BT - Tarif social					

19)		F2								BT - Tarif normal					
20)		F3								BT - Tarif éclairage public					
21)		F4								MT - Tarif monôme					
22)		RURALE A1								MT - Tarif binôme					
23)		RURALE A2								MT Tarif éclairage public					
24)		RURALE B1													
25)		RURALE B2													
26)		RURALE B3													
27)		RURALE B4													
28)		RURALE C1													
29)		RURALE C2													
30)		RURALE C3													

Source: Data collected by the authors

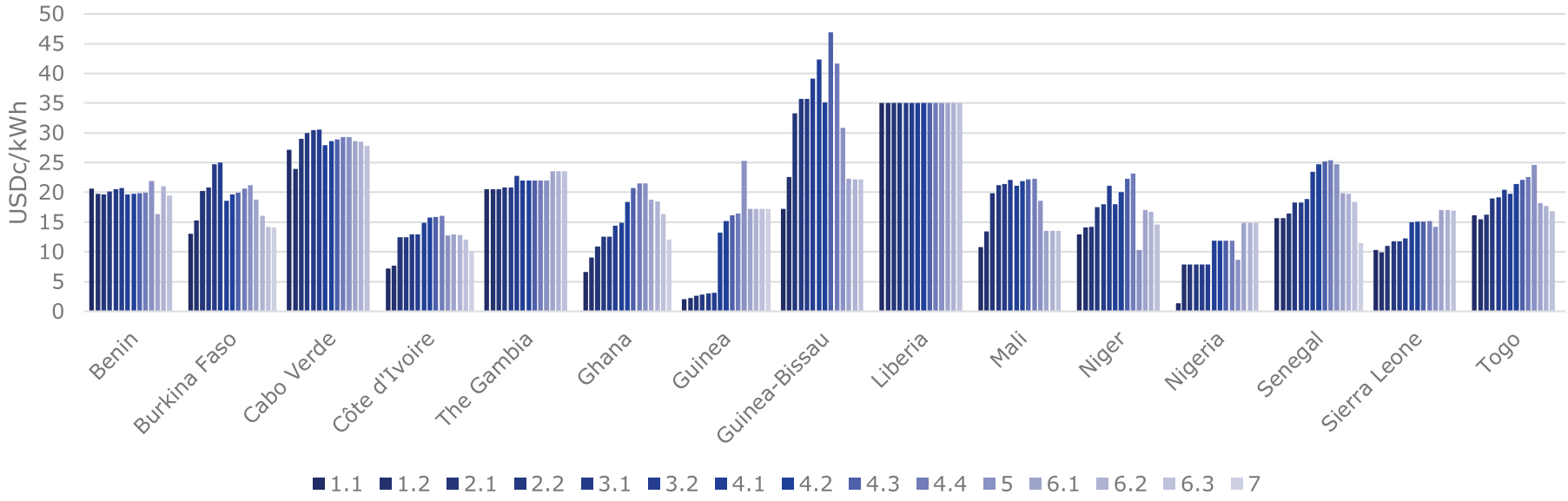
Table 49 - Electricity end-user tariff in US cents per kWh (without taxes) as of 2018

	Description	kW	kWh	Benin	Burkina	Cabo Verde	Côte d'Ivo.	Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
				SBEE	SONABEL	ELECTRA	CIE	NAWEC	ECG	EDG	EAGB	LEC	EDM	NIGELEC	ABUJA	SENELEC	EDSA	CEET
1.1	Social LV Consumer	1	50	20.7	13.0	27.2	7.2	20.5	6.6	2.1	17.3	35.0	10.7	12.9	1.3	15.7	10.3	16.2
1.2	Social LV Consumer	1	100	19.8	15.3	23.9	7.7	20.5	9.1	2.3	22.6	35.0	13.4	14.1	7.8	15.7	9.9	15.5
2.1	Single phase Domestic LV Consumer	2	250	19.6	20.2	29.0	12.5	20.5	10.9	2.6	33.3	35.0	19.8	14.2	7.8	16.5	10.9	16.3
2.2	Single phase Domestic LV Consumer	4	500	20.1	20.8	29.9	12.5	20.8	12.6	2.8	35.7	35.0	21.2	17.5	7.8	18.3	11.8	19.0
3.1	Three-phase Domestic LV Consumer	6	500	20.5	24.7	30.5	12.9	20.8	12.6	3.0	35.7	35.0	21.4	18.0	7.8	18.3	11.8	19.2
3.2	Three-phase Domestic LV Consumer	12	1000	20.7	25.0	30.5	12.9	22.8	14.4	3.1	39.1	35.0	22.1	21.1	7.8	18.9	12.2	20.4
4.1	Non domestic LV Consumer	2	500	19.6	18.6	27.9	14.9	22.0	14.9	13.2	42.3	35.0	21.1	18.0	11.8	23.4	15.0	19.7
4.2	Non domestic LV Consumer	6	1000	19.8	19.6	28.6	15.8	22.0	18.4	15.2	35.1	35.0	21.9	20.0	11.8	24.7	15.0	21.4
4.3	Non domestic LV Consumer	12	1800	19.8	19.9	28.9	15.9	22.0	20.7	16.1	46.9	35.0	22.2	22.3	11.8	25.2	15.1	22.1
4.4	Non domestic LV Consumer	20	2500	20.0	20.6	29.3	16.1	22.0	21.5	16.4	41.6	35.0	22.3	23.2	11.8	25.4	15.2	22.6
5	Street light	20	2500	21.9	21.2	29.3	12.7	22.0	21.5	25.3	30.8	35.0	18.6	10.3	8.7	24.7	14.2	24.6
6.1	MV Consumers	250	40000	16.4	18.8	28.6	12.9	23.5	18.7	17.2	22.2	35.0	13.5	17.0	14.9	19.9	17.0	18.2
6.2	MV Consumers	600	100000	21.0	16.1	28.5	12.8	23.5	18.5	17.2	22.2	35.0	13.5	16.7	14.9	19.7	17.0	17.7
6.3	MV Consumers	1000	250000	19.4	14.2	27.8	12.1	23.5	16.4	17.2	22.2	35.0	13.5	14.6	14.9	18.4	16.9	16.8
7	HV Consumers	10000	12000000	N/A	14.1	N/A	10.1	N/A	12.0	17.2	N/A	N/A	N/A	N/A	N/A	11.5	N/A	N/A

Note: Reactive energy: no penalty; TOU: 90% of consumption in off-peak hours, 10% of consumption in peak hours

Source: Calculations based on data collected by the authors

Figure 24- Electricity end-user tariff in US cents per kWh (without taxes) as of 2018



Ref: 1.1 = Social LV Consumer 1kW, 50kWh; 1.2 = Social LV Consumer 1kW,100kWh; 2.1 = Single phase Domestic LV Consumer 2kW, 250kWh; 2.2 = Single phase Domestic LV Consumer 4kW, 500kWh; 3.1 = Three-phase Domestic LV Consumer 6kW, 500kWh; 3.2 = Three-phase Domestic LV Consumer 12kW, 1000kWh; 4.1 = Non domestic LV Consumer 2kW, 500kWh; 4.2 = Non domestic LV Consumer 6kW, 1000 kWh; 4.3 = Non domestic LV Consumer 12kW, 1800kWh; 4.4 = Non domestic LV Consumer 20kW, 2500kWh; 5 = Street light 20kW, 2500kWh; 6.1 = MV Consumers 250kW, 40000kWh; 6.2 = MV Consumers 600kW; 100000 kWh; 6.3 = MV Consumers 1000kW, 250000kWh; 7 = HV Consumers 10000 kW,12000000 kWh

Source: Calculations based on data collected by the authors

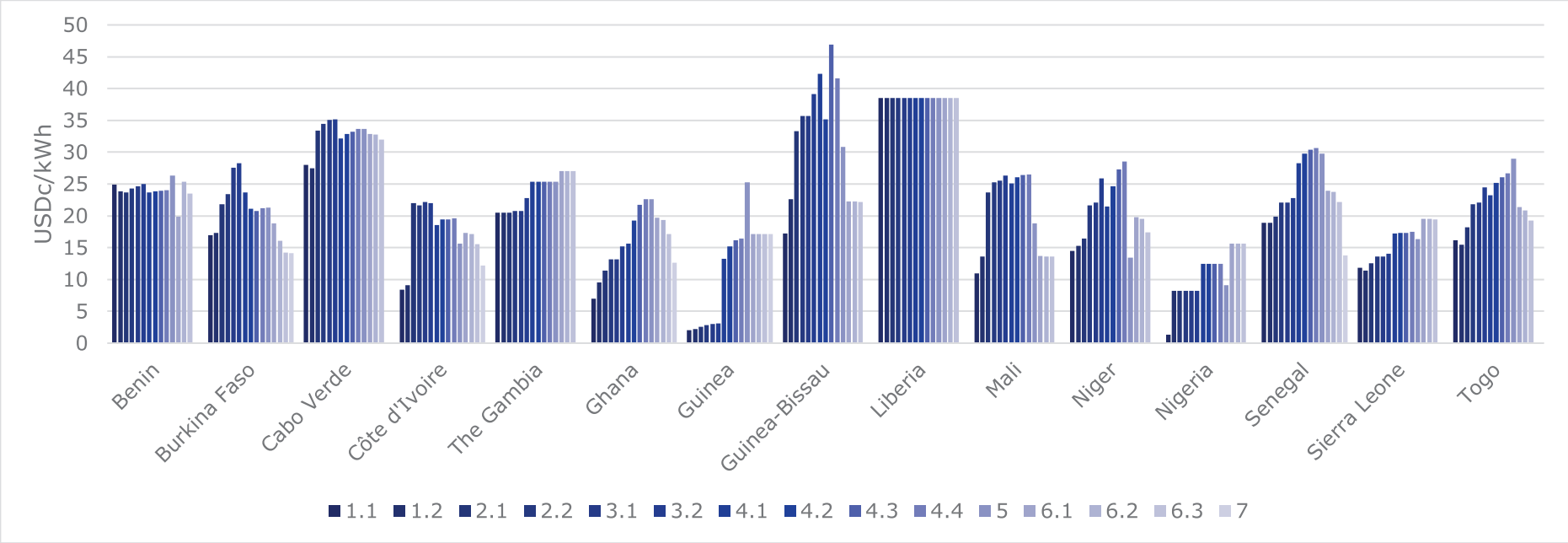
Table 50 - Electricity end-user tariff in US cents per kWh (with taxes and charges) as of 2018

	Description	kW	kWh	Benin	Burkina	Cabo Verde	Côte d'Ivo.	Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
				SBEE	SONABEL	ELECTRA	CIE	NAWEC	ECG	EDG	EAGB	LEC	EDM	NIGELEC	ABUJA	SENELEC	EDSA	CEET
1.1	Social LV Consumer	1	50	24.9	16.9	28.0	8.4	20.5	7.0	2.4	17.3	38.5	11.0	14.5	1.4	18.9	11.9	16.2
1.2	Social LV Consumer	1	100	23.9	17.3	27.5	9.1	20.5	9.5	2.7	22.6	38.5	13.6	15.3	8.2	18.9	11.4	15.5
2.1	Single phase Domestic LV Consumer	2	250	23.7	21.8	33.4	22.0	20.5	11.4	2.6	33.3	38.5	23.7	16.4	8.2	19.9	12.6	18.2
2.2	Single phase Domestic LV Consumer	4	500	24.3	23.4	34.4	21.7	20.8	13.2	2.8	35.7	38.5	25.3	21.6	8.2	22.1	13.6	21.8
3.1	Three-phase Domestic LV Consumer	6	500	24.7	27.6	35.1	22.2	20.8	13.2	3.0	35.7	38.5	25.5	22.1	8.2	22.1	13.6	22.1
3.2	Three-phase Domestic LV Consumer	12	1000	25.0	28.3	35.1	22.0	22.8	15.2	3.1	39.1	38.5	26.3	25.9	8.2	22.8	14.1	24.5
4.1	Non domestic LV Consumer	2	500	23.7	23.7	32.1	18.6	25.3	15.6	13.2	42.3	38.5	25.1	21.5	12.4	28.2	17.2	23.2
4.2	Non domestic LV Consumer	6	1000	23.9	21.1	32.9	19.4	25.3	19.3	15.2	35.1	38.5	26.0	24.6	12.4	29.7	17.3	25.2
4.3	Non domestic LV Consumer	12	1800	23.9	20.8	33.2	19.5	25.3	21.7	16.1	46.9	38.5	26.4	27.3	12.4	30.4	17.3	26.0
4.4	Non domestic LV Consumer	20	2500	24.1	21.2	33.7	19.6	25.3	22.6	16.4	41.6	38.5	26.5	28.5	12.4	30.6	17.5	26.7
5	Street light	20	2500	26.3	21.3	33.7	15.7	25.3	22.6	25.3	30.8	38.5	18.8	13.4	9.1	29.7	16.4	29.0
6.1	MV Consumers	250	40000	19.8	18.8	32.8	17.3	27.1	19.7	17.2	22.2	38.5	13.7	19.8	15.7	24.0	19.6	21.4
6.2	MV Consumers	600	100000	25.3	16.1	32.8	17.1	27.1	19.4	17.2	22.2	38.5	13.6	19.6	15.7	23.8	19.5	20.8
6.3	MV Consumers	1000	250000	23.5	14.2	32.0	15.5	27.1	17.2	17.2	22.2	38.5	13.6	17.4	15.7	22.1	19.5	19.2
7	HV Consumers	10000	12000000	N/A	14.1	N/A	12.2	N/A	12.6	17.2	N/A	N/A	N/A	N/A	N/A	13.8	N/A	N/A

Note: Reactive energy: no penalty; TOU: 90% of consumption in off-peak hours, 10% of consumption in peak hours,
No data for Guinea Bissau on applicable taxes

Source: Calculations based on data collected by the authors

Figure 25 - Electricity end-user tariff in US cents per kWh (with taxes and charges) as of 2018



Notes: taxes and charges of country are presented in Table 25 – EUT taxes, levies and charges applicable

Ref: 1.1 = Social LV Consumer 1kW, 50kWh; 1.2 = Social LV Consumer 1kW,100kWh; 2.1 = Single phase Domestic LV Consumer 2kW, 250kWh; 2.2 = Single phase Domestic LV Consumer 4kW, 500kWh; 3.1 = Three-phase Domestic LV Consumer 6kW, 500kWh; 3.2 = Three-phase Domestic LV Consumer 12kW, 1000kWh; 4.1 = Non domestic LV Consumer 2kW, 500kWh; 4.2 = Non domestic LV Consumer 6kW, 1000 kWh; 4.3 = Non domestic LV Consumer 12kW, 1800kWh; 4.4 = Non domestic LV Consumer 20kW, 2500kWh; 5 = Street light 20kW, 2500kWh; 6.1 = MV Consumers 250kW, 40000kWh; 6.2 = MV Consumers 600kW; 100000 kWh; 6.3 = MV Consumers 1000kW, 250000kWh; 7 = HV Consumers 10000 kW,12000000 kWh

Source: Calculations based on data collected by the authors

Table 51 – Grouping of customer categories

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Social				Domestique Social monophase BT		Residential - Lifeline consumers		Tariff LV social		BT - Tarif social	BT - Social	R1			
Domestic LV	BT1	A, B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5	BTN	Domestique Général BT, Domestique Conventionnel BT	Domestic	Residential - Other residential consumers	BT domestique privé monophasé, BT domestique privé triphasé	Tariff LV normal	Residential	BT - Tarif normal (includes different levels of demand)	BT - Général Domestique 3kW	R2, R3, R4	DPP, DMP, DGP (and prepayment)	T1	Domestique
Non-Domestic LV	BT2	D1, D2	BTE	Professionnel BT	Commercial, Central Government	Non-residential, SLT-LV	BT p. c.i. mon., BT p.c.i.tri., BT Institutions internat., ambassades et ONG mono et tri.,	Tariff LV businesses and commercial - monofase, Tariff LV businesses and commercial - trifase	NGO, Public corporation, LEC, Tax exempt	MT - Tarif monôme	BT - Général 6kW, BT - Général 12kW, BT - Général 18kW, BT - Général 30kW	C1,D1, A1	PPP, PMP, PGP (and prepayment)	T2	Non-Domestique
MV	M1A, M1B, M1C	E1, E2	MT	Courte utilisation MT, Générale utilisation MT, Longue utilisation MT	Agriculture, Hotel/Club /Industries	SLT-MV	MT et HT p.c.i., MT institutions internat., ambassades et ONG, BT, MT et HT de l'administ.	Tariff MV	Commercial	MT - Tarif binôme	MT - General, MT - Aménagements Hydro Agricoles	C2, D2, A2	TCU, TG, TLU	T3, T6	MT
HV	M1D, M1E	G		HT		SLT-HV, SLT-HV MINES	MT et HT professionnels, commerce et industries					C3, D3, A3	HT Général, Haute Tension Tarif Secours	T4	
Public lighting	BT3	F1, F2, F3, F4	IP	Eclairage Public	Area Councils	Street Lighting	BT, MT et HT de l'administration		Government	BT - Tarif éclairage public, MT Tarif éclairage public	BT - Eclairage Public	S1	Eclairage Public	T5	Eclairage Public

Note: the categories of each country are included in **Table 48**

Source: Calculations based on data collected by the authors

Table 52 – Key underlying drivers of EUT – Number of clients per category as of 2018

	Benin	Burkina Faso	Cabo Verde*****	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau****	Liberia	Mali	Niger	Nigeria**	Senegal	Sierra Leone	Togo*
1)		324730	171067	833,744	14647			14172	60829***			275854	1129678	170067	
2)	604167	313763		786,193	3682	3013488	275650		387		89599*	9244023	8208	19449	237010
3)				5,820	564	509812		6803	189		251878	9176	277782	2735	
4)				5,820	19		19418		12		47650	440	21990	645	1111
5)			856	10,369	488	888		100771	12		10431	1660131	612	9	23388
6)	977				1105	454	332				18484	59110	5236	674	1083
7)					158041	96	2233				2990	2493	78		65125
8)		24206				3					1339	55373	2042		560
9)						137	20				1339	55373	2042		560
10)							4180			300921	83*	5766	44		27
11)				58								2012	484		11
12)				5,110								22426	1267		4
13)		1458	211	207								8347	4		69
14)		198		2								1860	1		65
15)		1384										4762			4
16)		471													2
17)		1													
18)		1394													
19)										203753					
20)															
21)															
22)										2226					
23)															
24)															
25)															
26)															
27)															
28)															
29)															
30)															

*Data as of 2016

**Sum of 11 DISCOs

***Includes LEC plus distribution crossborder-supplied concessions

****Data as of 2015

*****Only ELECTRA, and as of 2016

Source: Calculations based on data collected by the authors

Table 53 – Key underlying drivers of EUT – Electricity distributed (GWh) per category as of 2018

	Benin	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea**	Guinea-Bissau****	Liberia	Mali*	Niger	Nigeria***	Senegal	Sierra Leone	Togo*
1)	364.2	190.847	141.2	382.2	8.1	274.5	TOTAL: 1117	14.2	41.15			523	1305.4	141.1	
2)	322	380.374		2117.2	1.8	4011.1			12.89			29,636	55.1	27.0	380.4
3)	23			32.2	45.4	851.4		6.8	10.84		347.0	744	234.0	5.8	
4)	143			592.2	1.0	478.2			0.85		124.7	489	161.4	81.5	4.0
5)	0		33.6	403.1	5.9	1302.0		100.8	5		46.6	4,999	13.0	0.03	146.5
6)	51				11.5	756.8					130.2	3,361	241.3	0.7	16.5
7)	1				149.3	8.9					54.7	2,280	11.6		27.2
8)	122	199.672			37.5	568.6					211.1**	270	904.2		138.7
9)			14.8		9.7					283.8		869	86.6		48.2
10)					0.2							4,566	12.6		41.5
11)				15.9	3.2							464	85.6		65.8
12)				2158.0								1,112	200.0		62.1
13)		72.2336	83.5	896.3								1,631	1305.4		1.3
14)		8.91863	34.8	49.5								401			18.8
15)		241.685													18.9
16)		320.686													380.4
17)		133.76													
18)		16.1347								247.6					
19)										360.0					
20)										22.6					
21)										14.3					
22)										544.2					
23)										0.5					
24)															
25)															
26)															
27)															
28)															
29)															
30)															

*Data as of 2016
**Data as of 2017
***Sum of 11 DISCOs
****Data as of 2015

Source: Calculations based on data collected by the authors

Table 54 – Key underlying drivers of EUT – Revenue (USD thousand) per category as of 2018

	Benin***	Burkina Faso	Cabo Verde	Côte d'Ivoire	The Gambia	Ghana	Guinea	Guinea-Bissau	Liberia	Mali*	Niger	Nigeria**	Senegal	Sierra Leone	Togo*
1)	TOTAL: 179842.1	TOTAL: 307448.5	40930.3	40,288.6	1637	537979.27	TOTAL: 93375.7	TOTAL: 22,203.1	14,400			4985.6	216317.6	20792	74930.8
2)				303,069.4	384	432913.52			4,510			1443882.9	10336.7	4618	
3)				187,342.3	10691	145715.88			3,790		51503.0	52698.0	55125.7	928	
4)				1,027.7	202	92243.401			300		21127.1	37597.6	40271.7	14885	274.7
5)			9960.5	61,780.2	1293	201895.18			1,750		9665.6	289335.9	2337.3	-	41662.9
6)					2526	52598.043					28719.0	245985.0	54239.1	123	5023.3
7)					30315	38901.244					12734.4	128575.9	2574.3		5935.8
8)					9499						36116.6	13254.5	169013.2		31095.1
9)			3479.2		2627							93690.1	13728.4		7767.0
10)					40							372189.1	1928.8		9186.7
11)				2,472.4	849							25783.8	18081.4		11939.4
12)				308,227.3	0							87518.5	27707.1		9493.5
13)			19282.2	117,500.2								116010.8	1056.3		177.4
14)			7797.6	6,486.6								29201.2			3431.1
15)															3069.2
16)															
17)															
18)										39765.9					
19)										73878.9					
20)										3959.7					
21)										2723.4					
22)										74112.6					
23)										92.3					
24)															
25)															
26)															
27)															
28)															
29)															
30)															

*Data as of 2016

**Sum of 11 DISCOs

***Estimate by consultant

Source: Calculations based on data collected by the authors

ANNEX II. DATA COLLECTION TEMPLATE

The Consultant developed a MS Excel data collection template to capture the data required for the assignment in each country. The data collection template contains the following worksheets:

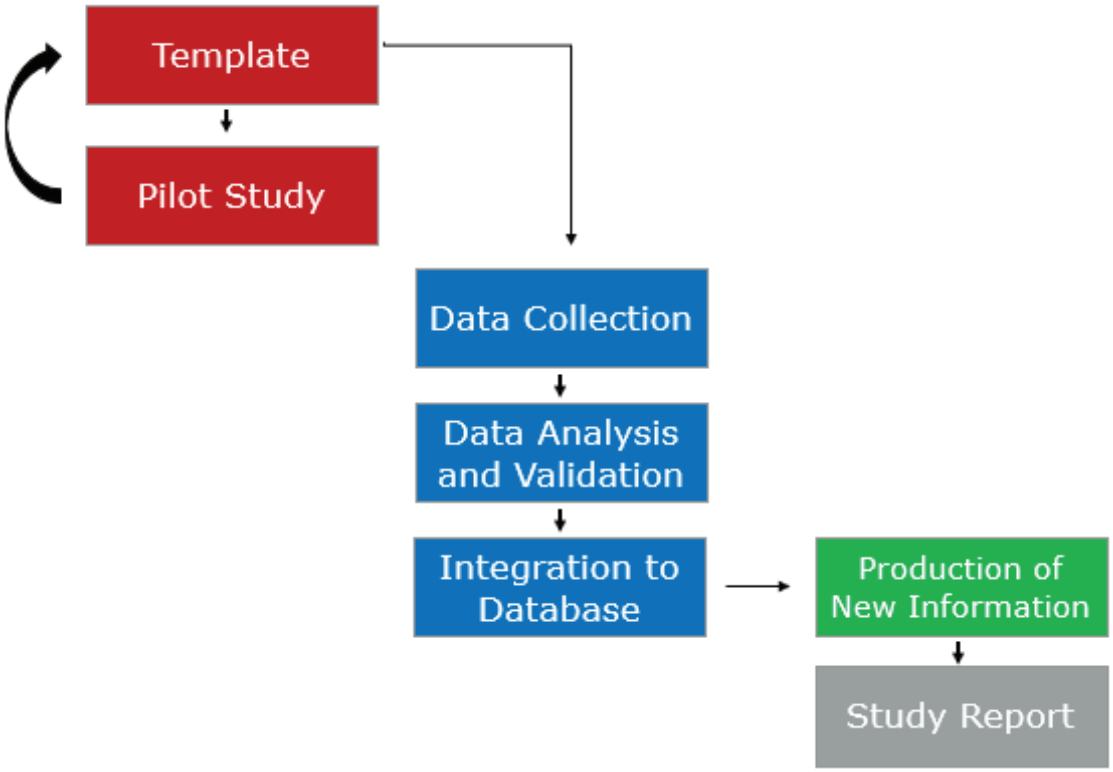
- **Introduction:** background of the project and guidelines for data contributors to effectively fill-in the questionnaire,
- **Identification:** information about the data contributor and supervisor,
- **Acronyms:** list of all acronyms used throughout the template,
- **Definitions:** definition of all datapoints,
- **0.General:** background datapoints,
- **1.TF:** datapoints regarding the institutional structure, market structure and regulatory structure of the electricity sector of each country,
- **2.BGT:** datapoints regarding the generation mix, nominal BGT, and key underlying drivers of the BGT of each country,
- **3.TT:** datapoints regarding the transmission tariff review (if applicable), nominal TT, and key underlying drivers of the TT of each country,
- **4.EUT:** datapoints regarding the distribution tariff review (if applicable), nominal EUT, subsidies, and key underlying drivers of the EUT of each country.

The Consultant presented the data collection template at the first meeting of ERERA's TPWG held on May 28th and 29th, 2019 in Accra, Ghana. Following the presentation, an enriching Q&A session followed, from which the Consultant incorporated the feedback into the questionnaire.

It was decided in-situ that all members of ERERA's TPWG will act as focal points. Focal points are the key contact in each country, who help coordinate and centralize data coming from different institutions in the data collection process. In countries with more than one TPWG member, the main focal point was designated from the regulatory agency.

The data collection template was tested in a Pilot Study of four countries: Cote d'Ivoire, Ghana, Nigeria and Senegal to obtain feedback and assess if modification or clarifications were required. The questionnaire was then considered finalized, and the Data Collection Phase was launched, as portrayed in the following figure.

Figure 26 – Methodology

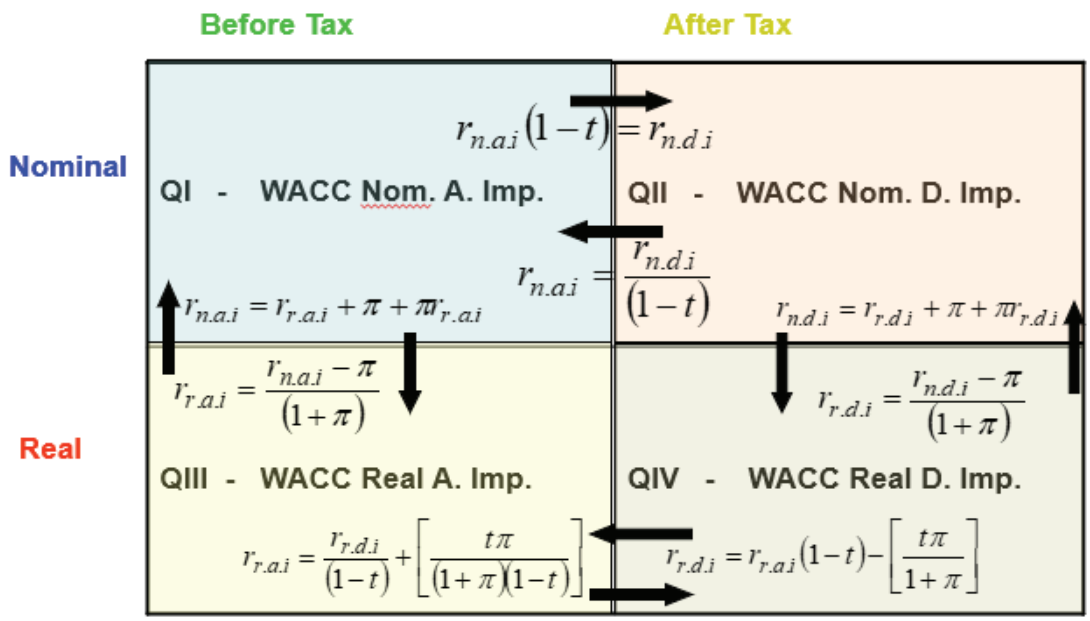


Source: own construction

ANNEX III. WACC CONVERSION

The following formulas are considered to convert WACC rates:

Figure 27 – Formulas to convert WACC rates



Source: Bullard and Gunter

ANNEX IV. CSV

Given that economies of scale and density are central issues in network economics such as electricity distribution, a composite scale variable (CSV) has been developed to see if simple comparisons between the countries can be made. The CSV consistsing of a weighted average of customer numbers, units of energy distributed, and network length as the sole independent variable for benchmarking analysis was constructed using the methodology developed by Ofgem (1999). The CSV is a robust variable that synthesizes, in an easy way, the scale of different companies. The following formula applies:

$$CSV = Cust. \times \left(1 + \beta \frac{\delta U}{U} + \gamma \frac{\delta L}{L}\right)$$

Cust. = Total number of consumers;

= Proportional deviation of energy delivered per customer in relation to the average

= Proportional deviation of the network extension per client in relation to the average

β = Weight of energy delivered per customer = 0.25

γ = Weight of network per customer = 0.25

The resulting CSV is presented in the table and figure below. For countries in which the CSV differs from customer numbers, it is suggested to use the CSV rather than customer numbers in order to compare operating costs per customer (in this case, per “adjusted customer”). This is because other underlying variables (i.e. electricity distributed and network length) may be overlooked drivers otherwise. Unfortunately, it was not possible to obtain OPEX data to carry such analysis in this study.

Table 55 - CSV

	Number of customers (million)	Sold energy per customer per month (kWh/ customer)	Length of distribution network per customer (m/ customers)	Deviation of sold energy	Deviation of km length	CSV	CSV / Number of customers
Benin	0.61	141.3	10.8	-0.32	-0.46	0.49	0.80
Burkina Faso	0.67	195.3	26.8	-0.06	0.35	0.71	1.07
Cabo Verde	0.17	149.0	21.2	-0.29	0.06	0.16	0.94
Côte d'Ivoire	1.65	336.2	28.0	0.61	0.41	2.07	1.26
The Gambia	0.18	79.3	5.5	-0.62	-0.72	0.12	0.66
Ghana	3.52	195.1	39.1	-0.07	0.96	4.32	1.22
Guinea	0.30	308.4	4.1	0.48	-0.80	0.28	0.92
Guinea-Bissau							
Liberia							
Mali	0.51	242.2	17.3	0.16	-0.13	0.51	1.01
Niger	0.42	176.0	18.8	-0.16	-0.05	0.40	0.95
Nigeria	11.35	376.9	19.8	0.81	-0.01	13.62	1.20
Senegal	1.98	156.5	11.1	-0.25	-0.44	1.63	0.83
Sierra Leone	0.19	110.3	28.6	-0.47	0.44	0.19	0.99
Togo	0.33	246.1	27.8	0.18	0.40	0.38	1.14

Source: Data Collection

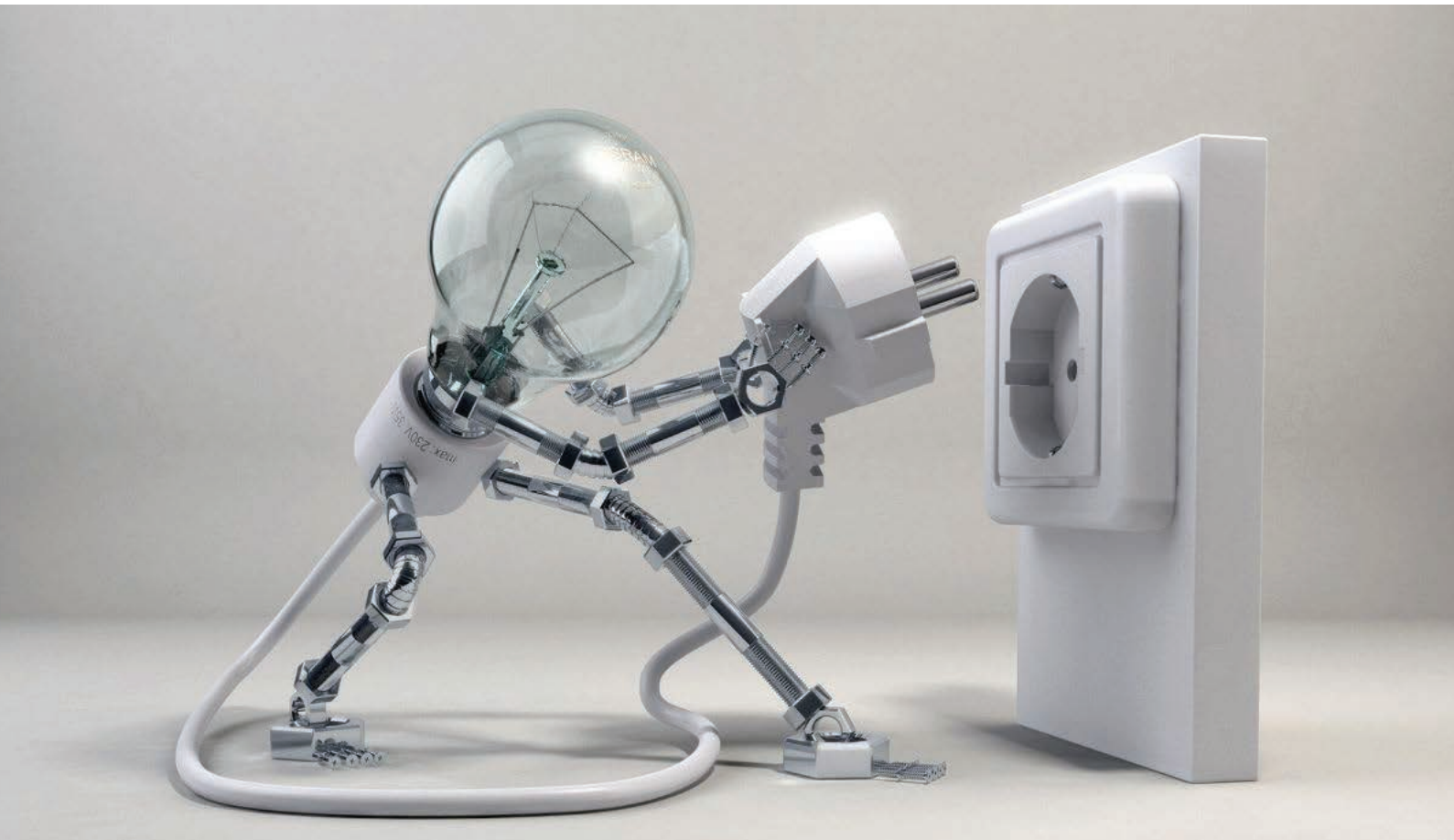
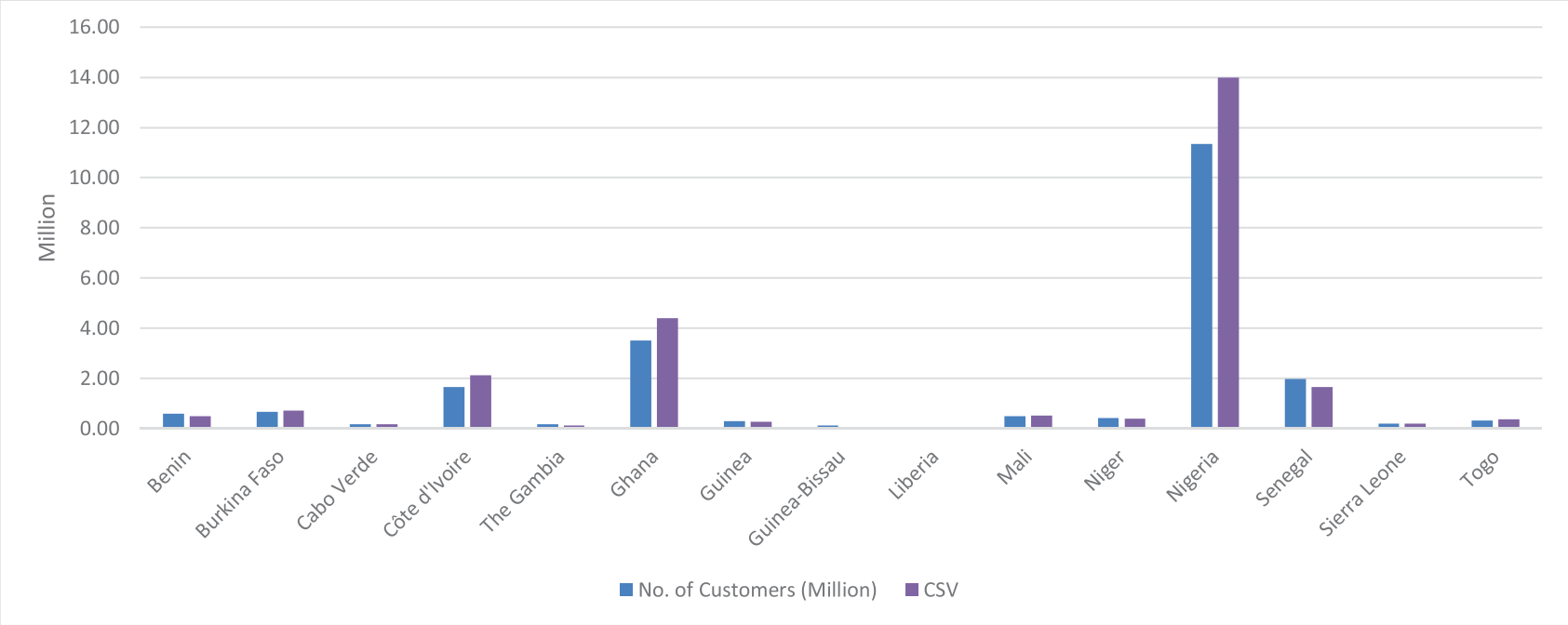


Figure 28 - CSV



Source: Data Collection

ANNEX V. TARIFF METHODOLOGY

The different regimes are differentiated by the incentives used, the associated risks, and the priorities given to the substantive objectives. The choice does not only depend on its theoretical strength or its technical appeal but will also be conditioned by the specific characteristics of the regulated market and the institutional political context in which the service is provided (general economic policy).

Cost Plus

The Cost Plus was the first mechanism used in the regulation of public services, counting with almost 100 years of application in various sectors: routes, electricity, gas, etc. It is based on the need to ensure the company a fair and reasonable rate of return to the effects that meets an essential service.

This method basically consists of directly setting an upper limit to the rate of return and determining the value of the service tariff that, given the sustainability restriction, allows the company to obtain the previously defined profitability.

This method does not imply that costs are not reviewed or that all costs of the company are admitted. The regulator has the power not to recognize costs that do not correspond to the activity or are unjustified costs.

A typical Cost-Plus formula is as follows[25]:

$$RR = OPEX + DEP + WACC * RAB + T - ADR$$

Where

RR = revenue requirement,

OPEX = allowed operating and maintenance costs (these include the cost of fuel, material

and replacement parts, energy purchases, supervision, personnel and overhead),

DEP = depreciation expenses on the company's gross assets (e.g. straight-line method; fixed assets in

construction progress are generally not depreciated),

WACC = allowed rate of return (average weighted interest rate on the company's long-term financial resources, including bonds, debt certificates, shares and preferred shares),

RAB = regulatory asset base, a measure of the value of the company's investment, calculated as its net assets, defined to be its gross assets less depreciation (includes net fixed assets such as plants, transmission and distribution facilities, other tangible and intangible fixed assets and nuclear fuel, less the cumulative depreciation for all these items, plus current assets, fuel and other material and replacement part inventories, advance payments and deferred revenue, research and development expenses and current asset requirements).

25 See Perez-Arriaga (2013)

T = taxes for which the company is liable (i.e., on profit, revenue and property, as well as social security and construction tax), and

ADR = additional revenue (expenses/revenues deriving from the sale of the company's property, revenues from wholesale energy sales and other revenues not directly related to producing electric power)

Incentive Based Regulation

Price Cap

The price cap method, like the other methods with high incentives for efficiency, is based on establishing mechanisms that encourage cost reduction, allowing the company to benefit from these improvements at first.

For this, it is essential to establish a regulatory period (regulatory lag) in which the company ensures that the savings it obtains can be appropriated. The regulatory lag can not be very short (e.g. 2 years) or very long (e.g. 6 years) since in the first case the company requires a minimum time to see the impacts of good management and in the second case the users delay in seeing the benefits of the regulatory mechanism.

With a fixed price, the profitability of the company is directly associated with its capacity to reduce its costs, which generates strong incentives to achieve productive efficiency via the minimization of costs. Here the service provider assumes a greater risk, since unexpected increases in costs or lower levels of demand than expected can result in serious losses for the lending company.

A typical Price Cap formula is as follows:

$$Tt = Tt - 1 * (1 + I - X) +/- (Q) +/- (K)$$

Where:

Tt = Rate in period t

T_{t-1} = Rate in period t-1

I = Inflation index (RPI = IPC)

X = Factor of increase in productivity

Q = Adjustment by quality levels

K = Adjustment for investments

Revenue Cap

Under the revenue cap approach, the maximum yearly revenues, the company is allowed to earn for a period of several years, are calculated with a formula that makes provision for yearly inflation less a correction factor associated with expected improvements in productivity. These revenues may be adjusted annually in accordance with one or several cost or revenue drivers that are beyond the control of the regulated company, such as the number of consumers, total energy supplied or, in network companies, the size of the network. Provision is also usually made for adjustments to compensate for exceptional events beyond the company's control.

A typical Revenue Cap formula is as follows:

$$Rt = Rt - 1 * (1 + I - X) +/- (Q) +/- (K)$$

Where:

Tt = Revenue in period t

T_{t-1} = Revenue in period t-1

I = Inflation index (RPI = IPC)

X = Factor of increase in productivity

Q = Adjustment by quality levels

K = Adjustment for investments

ANNEX VI. COUNTRY SUMMARIES

Figure 29– Benin country summary

A. Macroeconomic Overview	
GDP (current USD billion)	10.0
GDP per capita - PPP int.USD	2287.0
Access to electricity (% of population)	43%
Population (million, total in the country)	11.1
Population density (inhabitants per sq.km	96.9
Inflation, consumer prices (annual %)	1.0%

B. Tariff Framework	
Scope of involvement of regulator	21
Structure level (1 to 5)	4
Number of operators	
- Genco	1
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	219
- Thermal capacity	219
- Hydro capacity	0
- RER capacity	0
Electricity Production (GWh)	20
- Thermal production	20
- Hydro production	0
- RER production	0
System peak demand (MW)	222
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	1299
Proxy BGT (USD/MWh)	131

D. Transmission Tariff	
Proxy TT (USD/MWh)	17.4
Transmission losses (%)	5.4%
Transformer capacity (MVA)	865
Number of transformer (#)	19
Transmission Network length (km)	6251

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	24.9
- Domestic LV single-phase	23.7
- Domestic LV three-phase	24.7
- Non-domestic LV	23.7
- Street Light	26.3
- MV	19.8
Average EUT (USDc/kWh)	17.5
Contribution of each segment in the EUT	
- Generation (% of EUT)	52%
- Transmission (% of EUT)	19%
- Distribution + Supply (% of EUT)	29%
Revenue from electricity sales (% of GDP)	1.9%
Household income spent on electricity (%)	
Collection rate	91.2%
Distribution Network length (km)	6512
Total distribution losses (T + NT)	22.4%
SAIDI	65
SAIFI	28

Source: Data collected by the authors

Figure 30– Burkina Faso country summary

A. Macroeconomic Overview	
GDP (current USD billion)	13.7
GDP per capita - PPP int.USD	1866.6
Access to electricity (% of population)	25%
Population (million, total in the country)	19.2
Population density (inhabitants per sq.km	70.0
Inflation, consumer prices (annual %)	2.0%

B. Tariff Framework	
Scope of involvement of regulator	11
Structure level (1 to 5)	2
Number of operators	
- Genco	2
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Revenue Cap (RC)
Cost of capital rate	
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	354
- Thermal capacity	288
- Hydro capacity	32
- RER capacity	35
Electricity Production (GWh)	1021
- Thermal production	875
- Hydro production	91
- RER production	54
System peak demand (MW)	326
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	837
Proxy BGT (USD/MWh)	87

D. Transmission Tariff	
Proxy TT (USD/MWh)	
Transmission losses (%)	2.3%
Transformer capacity (MVA)	
Number of transformer (#)	
Transmission Network length (km)	1408

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	16.9
- Domestic LV single-phase	21.8
- Domestic LV three-phase	27.6
- Non-domestic LV	23.7
- Street Light	21.3
- MV	18.8
Average EUT (USDc/kWh)	19.7
Contribution of each segment in the EUT	
- Generation (% of EUT)	
- Transmission (% of EUT)	
- Distribution + Supply (% of EUT)	
Revenue from electricity sales (% of GDP)	2.5%
Household income spent on electricity (%)	
Collection rate	91.2%
Distribution Network length (km)	17889
Total distribution losses (T + NT)	13.6%
SAIDI	59
SAIFI	185.9

Source: Data collected by the authors

Figure 31– Cabo Verde country summary

A. Macroeconomic Overview	
GDP (current USD billion)	1.9
GDP per capita - PPP int.USD	6912.6
Access to electricity (% of population)	93%
Population (million, total in the country)	0.5
Population density (inhabitants per sq.km	135.5
Inflation, consumer prices (annual %)	1.3%

B. Tariff Framework	
Scope of involvement of regulator	13
Structure level (1 to 5)	2
Number of operators	
- Genco	4
- Transco	1
- Disco	2
Open Access (Y/N)	Yes
Methodology to calculate RR	"Price Cap" Preço Teto (PC)
Cost of capital rate	6%
Type of cost of capital rate	Nominal antes

C. Bulk Generation Tariff	
Capacity (MW)	183
- Thermal capacity	153
- Hydro capacity	0
- RER capacity	30
Electricity Production (GWh)	427
- Thermal production	337
- Hydro production	0
- RER production	89
System peak demand (MW)	74
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	143

D. Transmission Tariff	
Proxy TT (USD/MWh)	24.2
Transmission losses (%)	
Transformer capacity (MVA)	
Number of transformer (#)	
Transmission Network length (km)	79

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	18.6
- Domestic LV single-phase	33.6
- Domestic LV three-phase	35.3
- Non-domestic LV	32.3
- Street Light	33.9
- MV	33.1
Average EUT (USDc/kWh)	26.5
Contribution of each segment in the EUT	
- Generation (% of EUT)	62%
- Transmission (% of EUT)	9%
- Distribution + Supply (% of EUT)	29%
Revenue from electricity sales (% of GDP)	4.6%
Household income spent on electricity (%)	2.0%
Collection rate	
Distribution Network length (km)	3648
Total distribution losses (T + NT)	26.5%
SAIDI	24.4
SAIFI	30

Source: Data collected by the authors

Figure 32– Cote d'Ivoire country summary

A. Macroeconomic Overview	
GDP (current USD billion)	41.5
GDP per capita - PPP int.USD	3902.4
Access to electricity (% of population)	66%
Population (million, total in the country)	25.0
Population density (inhabitants per sq.km	77.5
Inflation, consumer prices (annual %)	0.3%

B. Tariff Framework	
Scope of involvement of regulator	4
Structure level (1 to 5)	3
Number of operators	
- Genco	5
- Transco	1
- Disco	1
Open Access (Y/N)	No
Methodology to calculate RR	Gouvernement / Ministère
Cost of capital rate	N/A
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	2189
- Thermal capacity	1310
- Hydro capacity	879
- RER capacity	0
Electricity Production (GWh)	9990
- Thermal production	7028
- Hydro production	2962
- RER production	0
System peak demand (MW)	1388
Cross-border electricity exports (GWh)	1078
Cross-border electricity imports (GWh)	16
Proxy BGT (USD/MWh)	38

D. Transmission Tariff	
Proxy TT (USD/MWh)	9.3
Transmission losses (%)	6.0%
Transformer capacity (MVA)	5396
Number of transformer (#)	132
Transmission Network length (km)	5413

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	Y
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	8.4
- Domestic LV single-phase	22.0
- Domestic LV three-phase	22.2
- Non-domestic LV	18.6
- Street Light	15.7
- MV	17.3
Average EUT (USDc/kWh)	15.5
Contribution of each segment in the EUT	
- Generation (% of EUT)	81%
- Transmission (% of EUT)	6%
- Distribution + Supply (% of EUT)	13%
Revenue from electricity sales (% of GDP)	2.7%
Household income spent on electricity (%)	5.1%
Collection rate	96.1%
Distribution Network length (km)	46185
Total distribution losses (T + NT)	15.0%
SAIDI	15
SAIFI	19

Source: Data collected by the authors

Figure 33– Gambia country summary

A. Macroeconomic Overview	
GDP (current USD billion)	1.6
GDP per capita - PPP int.USD	2642.2
Access to electricity (% of population)	56%
Population (million, total in the country)	2.1
Population density (inhabitants per sq.km	186.1
Inflation, consumer prices (annual %)	6.5%

B. Tariff Framework	
Scope of involvement of regulator	14
Structure level (1 to 5)	2
Number of operators	
- Genco	2
- Transco	1
- Disco	1
Open Access (Y/N)	No
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	13%
Type of cost of capital rate	Nominal

C. Bulk Generation Tariff	
Capacity (MW)	113
- Thermal capacity	113
- Hydro capacity	0
- RER capacity	0
Electricity Production (GWh)	828
- Thermal production	828
- Hydro production	0
- RER production	0
System peak demand (MW)	70
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	11
Proxy BGT (USD/MWh)	120

D. Transmission Tariff	
Proxy TT (USD/MWh)	
Transmission losses (%)	
Transformer capacity (MVA)	104
Number of transformer (#)	8
Transmission Network length (km)	533

E. End-User Tariff	
Structure of charges	
Fixed Charge	N
Capacity Charge	N
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	Y
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	20.5
- Domestic LV single-phase	20.5
- Domestic LV three-phase	20.8
- Non-domestic LV	25.3
- Street Light	25.3
- MV	27.1
Average EUT (USDc/kWh)	21.9
Contribution of each segment in the EUT	
- Generation (% of EUT)	
- Transmission (% of EUT)	
- Distribution + Supply (% of EUT)	
Revenue from electricity sales (% of GDP)	4.1%
Household income spent on electricity (%)	1.7%
Collection rate	94.0%
Distribution Network length (km)	980
Total distribution losses (T + NT)	22.0%
SAIDI	
SAIFI	

Source: Data collected by the authors

Figure 34– Ghana country summary

A. Macroeconomic Overview	
GDP (current USD billion)	62.1
GDP per capita - PPP int.USD	6099.3
Access to electricity (% of population)	79%
Population (million, total in the country)	28.9
Population density (inhabitants per sq.km	127.2
Inflation, consumer prices (annual %)	9.8%

B. Tariff Framework	
Scope of involvement of regulator	21
Structure level (1 to 5)	5
Number of operators	
- Genco	13
- Transco	1
- Disco	3
Open Access (Y/N)	Yes
Methodology to calculate RR	Hybrid
Cost of capital rate	
Type of cost of capital rate	Nominal

C. Bulk Generation Tariff	
Capacity (MW)	4770
- Thermal capacity	3168
- Hydro capacity	1580
- RER capacity	23
Electricity Production (GWh)	15818
- Thermal production	9800
- Hydro production	6017
- RER production	0
System peak demand (MW)	2371
Cross-border electricity exports (GWh)	740
Cross-border electricity imports (GWh)	140
Proxy BGT (USD/MWh)	89

D. Transmission Tariff	
Proxy TT (USD/MWh)	8.7
Transmission losses (%)	4.4%
Transformer capacity (MVA)	7191
Number of transformer (#)	134
Transmission Network length (km)	5610

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	7.0
- Domestic LV single-phase	11.4
- Domestic LV three-phase	13.2
- Non-domestic LV	15.6
- Street Light	22.6
- MV	19.7
Average EUT (USDc/kWh)	13.0
Contribution of each segment in the EUT	
- Generation (% of EUT)	55%
- Transmission (% of EUT)	6%
- Distribution + Supply (% of EUT)	39%
Revenue from electricity sales (% of GDP)	1.8%
Household income spent on electricity (%)	2.1%
Collection rate	86.8%
Distribution Network length (km)	137659
Total distribution losses (T + NT)	24.3%
SAIDI	129.8
SAIFI	59.8

Source: Data collected by the authors

Figure 35– Guinea country summary

A. Macroeconomic Overview	
GDP (current USD billion)	12.1
GDP per capita - PPP int.USD	2188.5
Access to electricity (% of population)	35%
Population (million, total in the country)	13.0
Population density (inhabitants per sq.km	52.8
Inflation, consumer prices (annual %)	9.7%

B. Tariff Framework	
Scope of involvement of regulator	18
Structure level (1 to 5)	2
Number of operators	
- Genco	5
- Transco	1
- Disco	1
Open Access (Y/N)	No
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	563
- Thermal capacity	195
- Hydro capacity	367
- RER capacity	0
Electricity Production (GWh)	1732
- Thermal production	521
- Hydro production	1211
- RER production	0
System peak demand (MW)	340
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	142

D. Transmission Tariff	
Proxy TT (USD/MWh)	3.7
Transmission losses (%)	0.0%
Transformer capacity (MVA)	370
Number of transformer (#)	
Transmission Network length (km)	551

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	2.4
- Domestic LV single-phase	3.0
- Domestic LV three-phase	3.6
- Non-domestic LV	15.6
- Street Light	20.3
- MV	20.8
Average EUT (USDc/kWh)	8.4
Contribution of each segment in the EUT	
- Generation (% of EUT)	81%
- Transmission (% of EUT)	4%
- Distribution + Supply (% of EUT)	15%
Revenue from electricity sales (% of GDP)	0.9%
Household income spent on electricity (%)	
Collection rate	70.0%
Distribution Network length (km)	1230
Total distribution losses (T + NT)	65.0%
SAIDI	238
SAIFI	91

Source: Data collected by the authors

Figure 36– Guinea Bissau country summary

A. Macroeconomic Overview	
GDP (current USD billion)	1.4
GDP per capita - PPP int.USD	1864.9
Access to electricity (% of population)	26%
Population (million, total in the country)	1.7
Population density (inhabitants per sq.km	47.1
Inflation, consumer prices (annual %)	1.4%

B. Tariff Framework	
Scope of involvement of regulator	
Structure level (1 to 5)	2
Number of operators	
- Genco	1
- Transco	1
- Disco	1
Open Access (Y/N)	No
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	10%
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	35
- Thermal capacity	10
- Hydro capacity	0
- RER capacity	25
Electricity Production (GWh)	126
- Thermal production	110
- Hydro production	0
- RER production	16
System peak demand (MW)	38
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	102

D. Transmission Tariff	
Proxy TT (USD/MWh)	14.9
Transmission losses (%)	
Transformer capacity (MVA)	
Number of transformer (#)	
Transmission Network length (km)	110

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	N
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	17.3
- Domestic LV single-phase	28.8
- Domestic LV three-phase	35.7
- Non-domestic LV	42.3
- Street Light	30.8
- MV	22.2
Average EUT (USDc/kWh)	18.2
Contribution of each segment in the EUT	
- Generation (% of EUT)	66%
- Transmission (% of EUT)	8%
- Distribution + Supply (% of EUT)	26%
Revenue from electricity sales (% of GDP)	1.6%
Household income spent on electricity (%)	
Collection rate	81.0%
Distribution Network length (km)	
Total distribution losses (T + NT)	31.0%
SAIDI	
SAIFI	

Source: Data collected by the authors

Figure 37– Liberia country summary

A. Macroeconomic Overview	
GDP (current USD billion)	3.2
GDP per capita - PPP int.USD	1404.5
Access to electricity (% of population)	21%
Population (million, total in the country)	4.7
Population density (inhabitants per sq.km	42.5
Inflation, consumer prices (annual %)	23.4%

B. Tariff Framework	
Scope of involvement of regulator	22
Structure level (1 to 5)	3
Number of operators	
- Genco	1
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	126
- Thermal capacity	38
- Hydro capacity	88
- RER capacity	0
Electricity Production (GWh)	201
- Thermal production	19
- Hydro production	182
- RER production	0
System peak demand (MW)	22
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	26

D. Transmission Tariff	
Proxy TT (USD/MWh)	66.5
Transmission losses (%)	
Transformer capacity (MVA)	92
Number of transformer (#)	5
Transmission Network length (km)	81

E. End-User Tariff	
Structure of charges	
Fixed Charge	N
Capacity Charge	N
Flat Tariff	Y
Consumption Block	N
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	38.5
- Domestic LV single-phase	38.5
- Domestic LV three-phase	38.5
- Non-domestic LV	38.5
- Street Light	38.5
- MV	38.5
Average EUT (USDc/kWh)	35.0
Contribution of each segment in the EUT	
- Generation (% of EUT)	52%
- Transmission (% of EUT)	19%
- Distribution + Supply (% of EUT)	29%
Revenue from electricity sales (% of GDP)	0.8%
Household income spent on electricity (%)	4.8%
Collection rate	82.0%
Distribution Network length (km)	
Total distribution losses (T + NT)	58.0%
SAIDI	96.4
SAIFI	29.3

Source: Data collected by the authors

Figure 38– Mali country summary

A. Macroeconomic Overview	
GDP (current USD billion)	16.6
GDP per capita - PPP int.USD	2384.0
Access to electricity (% of population)	44%
Population (million, total in the country)	18.5
Population density (inhabitants per sq.km	15.0
Inflation, consumer prices (annual %)	1.7%

B. Tariff Framework	
Scope of involvement of regulator	20
Structure level (1 to 5)	3
Number of operators	
- Genco	3
- Transco	2
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	8%
Type of cost of capital rate	Réel après

C. Bulk Generation Tariff	
Capacity (MW)	444
- Thermal capacity	261
- Hydro capacity	184
- RER capacity	0
Electricity Production (GWh)	1457
- Thermal production	696
- Hydro production	760
- RER production	0
System peak demand (MW)	353
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	459
Proxy BGT (USD/MWh)	76

D. Transmission Tariff	
Proxy TT (USD/MWh)	10.4
Transmission losses (%)	
Transformer capacity (MVA)	
Number of transformer (#)	
Transmission Network length (km)	2325

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	Y
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	10.9
- Domestic LV single-phase	23.6
- Domestic LV three-phase	25.5
- Non-domestic LV	25.1
- Street Light	16.8
- MV	17.9
Average EUT (USDc/kWh)	13.2
Contribution of each segment in the EUT	
- Generation (% of EUT)	85%
- Transmission (% of EUT)	8%
- Distribution + Supply (% of EUT)	7%
Revenue from electricity sales (% of GDP)	1.3%
Household income spent on electricity (%)	2.9%
Collection rate	98.0%
Distribution Network length (km)	8760
Total distribution losses (T + NT)	20.7%
SAIDI	168
SAIFI	62.5

Source: Data collected by the authors

Figure 39– Niger country summary

A. Macroeconomic Overview	
GDP (current USD billion)	8.9
GDP per capita - PPP int.USD	1216.8
Access to electricity (% of population)	13%
Population (million, total in the country)	19.3
Population density (inhabitants per sq.km	15.3
Inflation, consumer prices (annual %)	3.0%

B. Tariff Framework	
Scope of involvement of regulator	19
Structure level (1 to 5)	3
Number of operators	
- Genco	3
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Price Cap (PC)
Cost of capital rate	
Type of cost of capital rate	Nominal après

C. Bulk Generation Tariff	
Capacity (MW)	155
- Thermal capacity	155
- Hydro capacity	0
- RER capacity	0
Electricity Production (GWh)	200
- Thermal production	200
- Hydro production	0
- RER production	0
System peak demand (MW)	154
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	964
Proxy BGT (USD/MWh)	153

D. Transmission Tariff	
Proxy TT (USD/MWh)	
Transmission losses (%)	12.7%
Transformer capacity (MVA)	546
Number of transformer (#)	13
Transmission Network length (km)	1550

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	14.5
- Domestic LV single-phase	16.4
- Domestic LV three-phase	22.1
- Non-domestic LV	21.5
- Street Light	13.4
- MV	19.8
Average EUT (USDc/kWh)	17.5
Contribution of each segment in the EUT	
- Generation (% of EUT)	
- Transmission (% of EUT)	
- Distribution + Supply (% of EUT)	
Revenue from electricity sales (% of GDP)	2.0%
Household income spent on electricity (%)	3.0%
Collection rate	98.0%
Distribution Network length (km)	6262
Total distribution losses (T + NT)	14.0%
SAIDI	165
SAIFI	289

Source: Data collected by the authors

Figure 40– Nigeria country summary

A. Macroeconomic Overview	
GDP (current USD billion)	421.2
GDP per capita - PPP int.USD	5941.3
Access to electricity (% of population)	54%
Population (million, total in the country)	188.7
Population density (inhabitants per sq.km	207.2
Inflation, consumer prices (annual %)	12.1%

B. Tariff Framework	
Scope of involvement of regulator	27
Structure level (1 to 5)	5
Number of operators	
- Genco	15
- Transco	1
- Disco	11
Open Access (Y/N)	Yes
Methodology to calculate RR	Hybrid
Cost of capital rate	11%
Type of cost of capital rate	Real before tax

C. Bulk Generation Tariff	
Capacity (MW)	13651
- Thermal capacity	11713
- Hydro capacity	1938
- RER capacity	0
Electricity Production (GWh)	31686
- Thermal production	23994
- Hydro production	7692
- RER production	0
System peak demand (MW)	16660
Cross-border electricity exports (GWh)	2802
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	66

D. Transmission Tariff	
Proxy TT (USD/MWh)	12.8
Transmission losses (%)	8.4%
Transformer capacity (MVA)	16818
Number of transformer (#)	137
Transmission Network length (km)	12325

E. End-User Tariff	
Structure of charges	
Fixed Charge	N
Capacity Charge	N
Flat Tariff	Y
Consumption Block	N
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	1.4
- Domestic LV single-phase	8.2
- Domestic LV three-phase	8.2
- Non-domestic LV	12.4
- Street Light	9.1
- MV	15.7
Average EUT (USDc/kWh)	5.7
Contribution of each segment in the EUT	
- Generation (% of EUT)	50%
- Transmission (% of EUT)	15%
- Distribution + Supply (% of EUT)	35%
Revenue from electricity sales (% of GDP)	0.8%
Household income spent on electricity (%)	4.0%
Collection rate	66.0%
Distribution Network length (km)	224623
Total distribution losses (T + NT)	15.7%
SAIDI	742
SAIFI	304

Source: Data collected by the authors

Figure 41– Senegal country summary

A. Macroeconomic Overview	
GDP (current USD billion)	23.2
GDP per capita - PPP int.USD	3459.4
Access to electricity (% of population)	62%
Population (million, total in the country)	15.9
Population density (inhabitants per sq.km	82.3
Inflation, consumer prices (annual %)	0.5%

B. Tariff Framework	
Scope of involvement of regulator	17
Structure level (1 to 5)	3
Number of operators	
- Genco	10
- Transco	1
- Disco	7
Open Access (Y/N)	No
Methodology to calculate RR	Price Cap (PC)
Cost of capital rate	11%
Type of cost of capital rate	Réel avant

C. Bulk Generation Tariff	
Capacity (MW)	1181
- Thermal capacity	963
- Hydro capacity	75
- RER capacity	143
Electricity Production (GWh)	3838
- Thermal production	3302
- Hydro production	321
- RER production	215
System peak demand (MW)	642
Cross-border electricity exports (GWh)	11
Cross-border electricity imports (GWh)	321
Proxy BGT (USD/MWh)	144

D. Transmission Tariff	
Proxy TT (USD/MWh)	
Transmission losses (%)	2.8%
Transformer capacity (MVA)	3026
Number of transformer (#)	58
Transmission Network length (km)	581

E. End-User Tariff	
Structure of charges	
Fixed Charge	N
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	Y
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	18.9
- Domestic LV single-phase	19.9
- Domestic LV three-phase	22.1
- Non-domestic LV	28.2
- Street Light	29.7
- MV	24.0
Average EUT (USDc/kWh)	18.3
Contribution of each segment in the EUT	
- Generation (% of EUT)	
- Transmission (% of EUT)	
- Distribution + Supply (% of EUT)	
Revenue from electricity sales (% of GDP)	3.2%
Household income spent on electricity (%)	3.2%
Collection rate	88.9%
Distribution Network length (km)	21890
Total distribution losses (T + NT)	17.7%
SAIDI	95
SAIFI	50

Source: Data collected by the authors

Figure 42– Sierra Leone country summary

A. Macroeconomic Overview	
GDP (current USD billion)	3.8
GDP per capita - PPP int.USD	1561.1
Access to electricity (% of population)	23%
Population (million, total in the country)	7.4
Population density (inhabitants per sq.km	102.5
Inflation, consumer prices (annual %)	16.9%

B. Tariff Framework	
Scope of involvement of regulator	16
Structure level (1 to 5)	4
Number of operators	
- Genco	2
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Cost Plus / Rate of Return
Cost of capital rate	
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	183
- Thermal capacity	122
- Hydro capacity	61
- RER capacity	0
Electricity Production (GWh)	333
- Thermal production	72
- Hydro production	261
- RER production	0
System peak demand (MW)	125
Cross-border electricity exports (GWh)	0
Cross-border electricity imports (GWh)	0
Proxy BGT (USD/MWh)	100

D. Transmission Tariff	
Proxy TT (USD/MWh)	
Transmission losses (%)	
Transformer capacity (MVA)	195
Number of transformer (#)	5
Transmission Network length (km)	205

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	N
Flat Tariff	Y
Consumption Block	Y
TOU	N
Prepaid	N
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	11.9
- Domestic LV single-phase	12.6
- Domestic LV three-phase	13.6
- Non-domestic LV	17.2
- Street Light	16.4
- MV	19.6
Average EUT (USDc/kWh)	16.1
Contribution of each segment in the EUT	
- Generation (% of EUT)	
- Transmission (% of EUT)	
- Distribution + Supply (% of EUT)	
Revenue from electricity sales (% of GDP)	1.1%
Household income spent on electricity (%)	2.6%
Collection rate	88.0%
Distribution Network length (km)	5534
Total distribution losses (T + NT)	38.0%
SAIDI	92
SAIFI	35

Source: Data collected by the authors

Figure 43– Togo country summary

A. Macroeconomic Overview	
GDP (current USD billion)	5.1
GDP per capita - PPP int.USD	1670.7
Access to electricity (% of population)	48%
Population (million, total in the country)	7.7
Population density (inhabitants per sq.km	135.6
Inflation, consumer prices (annual %)	0.7%

B. Tariff Framework	
Scope of involvement of regulator	14
Structure level (1 to 5)	3
Number of operators	
- Genco	4
- Transco	1
- Disco	1
Open Access (Y/N)	Yes
Methodology to calculate RR	Revenue Cap (RC)
Cost of capital rate	N/A
Type of cost of capital rate	

C. Bulk Generation Tariff	
Capacity (MW)	231
- Thermal capacity	165
- Hydro capacity	67
- RER capacity	0
Electricity Production (GWh)	592
- Thermal production	396
- Hydro production	196
- RER production	0
System peak demand (MW)	231
Cross-border electricity exports (GWh)	5
Cross-border electricity imports (GWh)	1453
Proxy BGT (USD/MWh)	83

D. Transmission Tariff	
Proxy TT (USD/MWh)	17.4
Transmission losses (%)	5.8%
Transformer capacity (MVA)	1400
Number of transformer (#)	22
Transmission Network length (km)	2038

E. End-User Tariff	
Structure of charges	
Fixed Charge	Y
Capacity Charge	Y
Flat Tariff	Y
Consumption Block	Y
TOU	Y
Prepaid	Y
Tariff of standard consumers (USDc/kWh) - with taxes	
- Social LV	16.2
- Domestic LV single-phase	18.2
- Domestic LV three-phase	22.1
- Non-domestic LV	23.2
- Street Light	29.0
- MV	21.4
Average EUT (USDc/kWh)	21.0
Contribution of each segment in the EUT	
- Generation (% of EUT)	40%
- Transmission (% of EUT)	8%
- Distribution + Supply (% of EUT)	52%
Revenue from electricity sales (% of GDP)	4.3%
Household income spent on electricity (%)	3.4%
Collection rate	94.4%
Distribution Network length (km)	9120
Total distribution losses (T + NT)	14.3%
SAIDI	89
SAIFI	39

Source: Data collected by the authors

ANNEX VII. TARIFF DECREES

The following figures provide the applicable EUT as of 2018 in each country.

Figure 44– Benin tariff decree

	BT1 : Usages domestiques			BT2	BT3
	Tranche sociale	**Tranche 1**	**Tranche 2**		
Catégorie de clients par rapport à l'usage	Consommation inférieure à 20 kWh le mois	Consommation supérieure à 20 et inférieure ou égale à 250 kWh le mois	Le reste de la consomation supérieure à 250 kWh	**Usages professionnels** (Boutiques, Salons de coiffure, de Couture, Cafés, Restaurants, Menuiseries.	**Eclairage public, Municipalités**
Prix du kWh consommé	Tranche exonérée de la	Tranche assujettie à la TVA	Tranche assujettie à la TVA	Tranche assujetti à la TVA	Tranche assujettie à la TVA
	78 F CFA	**109 F CFA**	**115 F CFA**	**111 F CFA**	**122 CFA**
Contribution des clients au Fonds d'électrification rurale	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA
Tarif d'entretien par kVA souscrite	500 F CFA par KVA souscrit	500 F CFA par KVA souscrit	500 F CFA par KVA souscrit	500 F CFA par KVA souscrit	500 F CFA par KVA souscrit

	MT0	Tous Clients HTA livrés en Moyenne Tension 15, 20 ou 33 kV			
		MT1	**MT2 = M2B**	**MT3**	**MT4 = M2A**
	M1A	M1B	M1C	M1D	M1E
Catégorie de clients	Clients HTA livrés en comptage BT et dont la puissance souscrite (PS) est comprise entre 40 kVA et 400 kVA (40 kVA<PS<400 kVA)	Clients HTA livrés en MT et dont la puissance souscrite (PS) est comprise entre 200 kVA et 400 KVA (200 kVA≤PS<400 kVA)	Clients HTA livrés en MT et dont la puissance souscrite (PS) est supérieure ou égale à 400 kVA	Industries pures (coupure totale à la pointe)	Industries pures (sans coupure à la pointe)
Prix du kWh	**111 F CFA**	**94 F CFA**	**94 F CFA**	**78 F CFA**	**78 F CFA**
Prime fixe	0	0	4500 F CFA par KVA souscrite à la pointe	0	7000 F CFA par KVA souscrite à la pointe
Contribution au Fonds d'électrification rurale	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA	3 F CFA exonérée de la TVA
Tarif d'entretien compteur sans horloge	2 524 F CFA				
Tarif d'entretien compteur avec horloge	3 554 F CFA				
Tarif d'entretien branchement	11 813 FCFA				

Source: Data collected by the authors

Figure 45– Burkina Faso country tariff decree

TENSION		Catégories et tranches tarifaires	FACTURATION DES CONSOMMATIONS (en FCFA)					FRAIS D'ABONNEMENT (en FCFA)				
			Tarifs du kWh			Redevance	PRIME FIXE	Avance sur Consommation	Frais ETS police et de pose	Timbres	Liasses	TOTAL Abonnement
BASSE TENSION BT	MONOPHASE 2 FILS	I) USAGE DOMESTIQUE PARTICULIERS ET ADMINISTRATION										
		Tarif type A (monophasé)	Tranche 1	Tranche 2	Tranche 3							
			0 à 75 kWh	75 à 100 kWh	plus de 100 kWh							
		1 à 3A	75	128	138	1 132	0	3 375	691	400	108	4 574
		Tarif type B (monophasé)	Tranche 1	Tranche 2	Tranche 3							
			0 à 50 kWh	51 à 200 kWh	plus de 200 kWh							
		5A	96	102	109	457	1 774	8 175	691	400	108	9 374
		10A	96	102	109	457	3 548	16 350	691	400	108	17 549
		15A	96	102	109	457	5 322	24 525	691	400	108	25 724
		20A	96	102	109	764	7 096	32 700	691	400	108	33 899
		25A	96	102	109	764	8 870	40 875	691	400	108	42 074
		30A	96	102	109	764	10 644	49 050	691	400	108	50 249
	TRIPHASE 4FILS	II) USAGE DOMESTIQUE ET FORCE MOTRICE PARTICULIERS ET ADMINISTRATION	Tranche 1	Tranche 2	Tranche 3							
		Tarif type C (triphasé)	0 à 50 kWh	51 à 200 kWh	plus de 200 kWh							
		10A	96	108	114	1 226	10 613	51 300	1 380	400	108	53 188
		15A	96	108	114	1 226	15 918	76 950	1 380	400	108	78 838
		20A	96	108	114	1 373	21 224	102 600	1 380	400	108	104 488
		25A	96	108	114	1 373	26 531	128 250	1 380	400	108	130 138
		30A	96	108	114	1 373	31 837	153 900	1 380	400	108	155 788
	DOUBLE TARIF	III) B.T. / TARIFS HORAIRES PARTICULIERS ET ADMINISTRATION	Heures de pointe (10h à 14 h et 16h à 19h)		Heures pleines (0h à 10h, 14h à 16h et 19h à 0h)							
		Tarif type D1 Non industriel	165		88	8 538	34 582 FCFA par kW par an	PS X 100 X 165	1 380	4 000	108	
		Tarif type D2 Industriel	140		75	7 115	28 818 FCFA par kW par an	PS X 100 X 140	1 380	4 000	108	
MOYENNE TENSION (MT)		IV) M.T. / TARIFS HORAIRES PARTICULIERS ET ADMINISTRATION	Heures de pointe (10h à 14 h et 16h à 19h)		Heures pleines (0h à 10h, 14h à 16h et 19h à 0h)							
		Tarif type E1 Non industriel	139		64	8 538	70 828 FCFA par kW par an	PS X 100 X 139	1 380	4 000	108	
		Tarif type E2 Industriel	118		54	7 115	64 387 FCFA par kW par an	PS X 100 X 118	1 380	4 000	108	
INDUSTRIES EXTRACTIVES ET HAUTE TENSION (HT)		V) H.T. / TARIFS HORAIRES PARTICULIERS	Heures de pointe (10h à 24 h)		Heures pleines (0h à 10h)							
		Tarif type G	140		70	7 115	64 387 FCFA par kW par an	PS X 100 X 118	1 380	4 000	108	
ECLAIRAGE PUBLIC Tarif type F		5A - 15A mono	122			381	- PS = Puissance Souscrite					
		20A et plus mono	122			637	- Pour la BT double tarif, la MT et la HT : Pénalisation si Cos phi < 0,8 et Bonification si Cos phi > 0,8					
		10A - 15A triphasé	122			1 022	- L'administration est dispensée du versement de l'avance sur consommation					
		20A et plus triphasé	122			1 144	- Pour la BT double tarif, la MT et la HT : les frais de timbres sont de 400 FCFA par jeu de page en double du contrat soit au total 4000 FCFA					

Source: Data collected by the authors

Figure 46– Cabo Verde tariff decree

TARIFA DE ELECTRICIDADE ELECTRA, S.A.R.L.			
Escalões			
Baixa Tensão Doméstica	Tarifa base	IVA (15%)	Tarifa c/IVA
<= 60 KWh/mês	22,69	3,40	26,09
> 60 KWh/mês	29,55	4,43	33,98
□□			
Baixa Tensão Especial	25,70	3,85	29,55
Média Tensão	21,38	3,21	24,59
Iluminação Pública	22,69	3,40	26,09
Consumo Interno da Produção de Agua	21,70	□□	

Source: Data collected by the authors

Figure 47– Cote d'Ivoire country tariff decree

LV

Tarif Domestique Social monophasé basse tension en régime post-paiement	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe par bimestre	559	0	559
Prix du kWh <= 80kWh/bimestre	36,05	0	36,05
Prix du kWh > 80kWh/bimestre	62,70	11,29	73,99
Redevance électrification rurale par bimestre			100
Redevance électrification rurale par kWh			1
Relevance RTI par kWh			2,0
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Abidjan par kWh			2,5
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Autres communes par kWh			1,0

- *1ère tranche de facturation : part de la consommation d'énergie <= 80kWh/bimestre*
- *2ème tranche de facturation : part de la consommation > 80kWh/bimestre.*

Tarif Domestique Général basse tension en régime post-paiement	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe kVA par bimestre	1 246,56	224,38	1 470,94
Prix du kWh <= 180xPuissance souscrite par bimestre	66,96	12,05	79,01
Prix du kWh > 180xPuissance souscrite par bimestre	58,04	10,45	68,48
Redevance électrification rurale par bimestre			100
Redevance électrification rurale par kWh			1,06
Redevance RTI par bimestre			2 000
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Abidjan par kWh			2,50
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Autres communes par kWh			1,00

- *1ère tranche de facturation : part de la consommation d'énergie <=180h x Puissance souscrite par bimestre*
- *2ème tranche de facturation : part de la consommation > 180 h x Puissance souscrite par bimestre.*

Tarif Professionnel Général basse tension en régime post-paiement	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe kVA par bimestre	1 552,10	279,38	1 831,48
Prix du kWh <= 180xPuissance souscrite par bimestre	86,31	15,54	101,84
Prix du kWh > 180xPuissance souscrite par bimestre	73,40	13,21	86,62
Redevance électrification rurale par bimestre			100
Redevance électrification rurale par kWh			1,10
Redevance RTI par bimestre			2 000
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Abidjan par kWh			2,50
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Autres communes par kWh			1,00

- *1ère tranche de facturation : part de la consommation d'énergie <=180h x Puissance souscrite par bimestre*
- *2ème tranche de facturation : part de la consommation > 180 h x Puissance souscrite par bimestre.*

Tarif Domestique Conventionnel basse tension en régime post-paiement	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prix du kWh par bimestre	17,82	3,21	21,03
Redevance électrification rurale par bimestre			100
Redevance électrification rurale par kWh			1,10
Redevance RTI par bimestre			2 000
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Abidjan par kWh			2,50
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Autres communes par kWh			1,00

Article 7 : Le Tarif Eclairage Public basse tension est modifié et se présente comme suit :

Tarif Eclairage Public basse tension en régime post-paiement	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prix du kWh par bimestre	73,40	13,21	86,62
Redevance électrification rurale par kWh			1,10
Taxe rémunératoire pour l'Enlèvement des Ordures Ménagères-Abidjan par kWh			2,50

MV

TARIF COURTE UTILISATION	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe annuelle par kW souscrit	19 330,01	3 479,40	22 809,42
Prix du kWh			
Heures pleines	66,84	12,03	78,87
Heures de pointe	103,42	18,62	122,04
Heures creuses	48,02	8,64	56,66
Redevance RTI par mois			1000
Redevance électrification rurale annuelle par kW souscrit			1 870

TARIF GENERAL	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe annuelle par kW souscrit	26 595,78	4 787,24	31 383,02
Prix du kWh			
Heures pleines	58,55	10,54	69,09
Heures de pointe	79,84	14,37	94,21
Heures creuses	48,45	8,72	57,17
Redevance RTI par mois			1000
Redevance électrification rurale annuelle par kW souscrit			1 870

TARIF LONGUE UTILISATION	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe annuelle par kW souscrit	38 644,52	6 956,01	45 600,53
Prix du kWh			
Heures pleines	56,19	10,11	66,30
Heures de pointe	71,38	12,85	84,23
Heures creuses	48,85	8,79	57,64
Redevance RTI par mois			1000
Redevance électrification rurale annuelle par kW souscrit			1 870

HV

TARIF HAUTE TENSION	FCFA (HT)	TVA (18%)	FCFA (TTC)
Prime fixe annuelle par kW souscrit	47 844,57	8 612,02	56 456,59
Prix du kWh			
Heures pleines	53,38	9,61	62,99
Heures de pointe	67,81	12,21	80,02
Heures creuses	46,41	8,35	54,77
Redevance RTI par mois			1000
Redevance électrification rurale annuelle par kW souscrit			1 870

Note: prepayment not considered

Source: Data collected by the authors

Figure 48– Gambia tariff decree

Category	PURA's Determination D/kWh
Domestic	10.14
Commercial	10.90
Hotel / Club / Industries	11.65
Agriculture	10.14
Area Councils	10.90
Central Government	10.90
Average Price	10.86

Source: Data collected by the authors

Figure 49– Ghana tariff decree

Tariff Category (EUT)			Effective 1 October 2018
Residential			
0-50	-	(GHp/kWh)	27.6858
51-300	-	(GHp/kWh)	55.5450
301 – 600	-	(GHp/kWh)	72.0866
601+	-	(GHp/kWh)	80.0963
Service Charge:			
Lifeline Consumers	-	(GHp/month)	213.0000
Other Residential Consumers	-	(GHp/month)	633.1717
Non-Residential			
0-100	-	(GHp/kWh)	67.7536
101-300	-	(GHp/kWh)	67.7536
301 – 600	-	(GHp/kWh)	72.0971
601+	-	(GHp/kWh)	113.7598
Service Charge	-	(GHp/month)	1055.2862
SLT-LV			
Maximum Demand Charge	-	(GHp/kVA/month)	5909.6029
Energy Charge	-	(GHp/kWh)	75.6640
Service Charge (GHp/month)	-		4221.1449
SLT-MV			
Max. Demand	-	(GHp/kVA/month)	5065.3739
Energy Charge	-	(GHp/kWh)	58.5683
Service Charge (GHp/month)	-		5909.6029
SLT-HV			
Max. Demand	-	(GHp/kVA/month)	5065.3739
Energy Charge	-	(GHp/kWh)	53.8196
Service Charge (GHp/month)	-		5909.6029
SLT-HV MINES			
Max. Demand	-	(GHp/kVA/month)	5909.6029
Energy Charge	-	(GHp/kWh)	102.5739
Service Charge	-	(GHp/month)	5909.6029

*Includes Regulatory Levy of GHp 0.5330/KWh

Source: Data collected by the authors

Figure 50– Guinea tariff decree

1. Tarif domestique privé Basse Tension

Prime fixe en GNF	Tranche en kWh pour 30 jours de consommation	Tarif en GNF
Monophasé = 4 850 Triphasé = 14 550	1 à 60 kWh	90
	61 à 330 kWh	255
	Plus de 330 kWh	292

2. Tarif privé Basse Tension Professionnels, Commerce et industries

Prime fixe en GNF	Tranche en kWh pour 30 jours de consommation	Tarif en GNF
Monophasé = 5 240	1 à 330 kWh	1 000
Triphasé = 15 720	Plus de 330 kWh	1 560

3. Tarif prive Moyenne et Haute Tension Professionnels, commerce et industries

Prime fixe en GNF par puissance souscrite	Tranche en kWh pour 30 jours de consommation	Tarif en GNF
6 312	Tranche unique	1 560

4. Tarif Basse et Moyenne Tension Institutions internationales, Ambassades et ONG

Prime fixe en GNF par puissance souscrite	Tranche en kWh pour 30 jours de consommation	Tarif en GNF
Monophasé = 5 240	Tranche unique	2 500
Triphasé = 15 720	Tranche unique	2 500
MT par puissance souscrite = 6 312	Tranche unique	2 500

5. Tarif Basse, Moyenne et Haute Tension de l'administration

Prime fixe en GNF	Tranche en kWh pour 30 jours de consommation	Tarif en GNF
0	Tranche unique	2 295

Source: Data collected by the authors

Figure 51– Guinea Bissau tariff decree

Composante	Unité	Tarifs en FCFA
Tarifs Normaux (utilisation générale)		
BT Tarif Normal		
Prime Fixe en Monophase/ mois		3 649
Prime Fixe en Triphasé/ mois		21 892
1e echelle < 200 KWh/mois	KWh	128
2e échelle > 200 KWh/mois	KWh	245
MT Tarif Moyen Tension		
Prime Fixe par KVA installé/mois	KVA	5 838
Electricité active, heures pleines	KWh	128
Option - Active, heures creuses (non applicable)	KWh	102
Réactive au-delà de 0,75 active	KVARh	38
Tarifs Spéciaux		
BT Tarif Social - *seulement en Monophase*		
Prime Fixe/mois		920
1e échelle <50 kWh/mois	KWh	81
2e échelle: 50 à 200 kWh/mois	KWh	161
3e échelle > 200 kWh/mois	KWh	322
BT Tarif Entreprises et commerces		
Prime Fixe en Monophase/mois		41 388
Prime Fixe en Triphasé/mois		197 042
Electricité active, heures pleines	KWh	161
Option - Active, heures creuses (non applicable)		129
Réactive au-delà de 0,75 active (non applicable)	KVARh	48

Source: Data collected by the authors

Figure 52– Liberia tariff decree

Flat tariff: 0.35 USD/kWh (without tax) for all categories

Source: Data collected by the authors

Figure 53– Mali tariff decree

CATEGORIES TARIFAIRES	Tarifs hors TVA	TVA (en %)	Tarifs avec TVA
TARIF SOCIAL (Compteurs 2 fils 5 Ampères)			
Prix proportionnel (FCFA/KWh)			
Tranche 1 : 0 - 50 kWh par mois	**59**	0	**59**
Tranche 2 : 51 - 100 kWh par mois	**94**	0	**94**
Tranche 3 : 101-200kWh par mois	**109**	18	**129**
Tranche 4 : > 200 kWh par mois	**130**	18	**153**
TARIF NORMAL (Compteurs 2 fils > 5 Ampères et compteurs 4 fils)			
Prix proportionnel (FCFA/kWh)			
Tranche 1 : 0 - 200 kWh par mois	**109**	18	**129**
Tranche 2 : > 200 kWh par mois	**130**	18	**153**
TARIF ECLAIRAGE PUBLIC			
Pour les 120 premières heures d'utilisation de la puissance souscrite	**114**	18	**135**
Pour le surplus	**79**	18	**93**

TABLEAU E4 : REDEVANCES MENSUELLES POUR LOCATION ET ENTRETIEN DES COMPTEUR BASSE TENSION

Type de comptage	Puissance Souscrite (KVA)	Tarifs hors TVA (FCFA)	TVA (en %)	Tarifs avec TVA (FCFA)
COMPTEURS MONOPHASES 2 FILS				
5 ampères	1,1	176	18	208
10 ampères	2,2	540	18	637
15 ampères	3,3	688	18	812
20 ampères	4,4	972	18	1 147
25 ampères	5,5	1 215	18	1 434
30 ampères	6,6	1 566	18	1 848
35 ampères	7,7	1 834	18	2 164
40 ampères	8,8	2 096	18	2 473
45 ampères	9,9	2 358	18	2 782
50 ampères	11,0	2 620	18	3 092
55 ampères	12,1	2 882	18	3 401
60 ampères	13,2	3 144	18	3 710
COMPTEURS TRIPHASES 4 FILS				
10 ampères	6,6	1 566	18	1 848
15 ampères	9,9	1 769	18	2 087
20 ampères	13,2	1 890	18	2 230
25 ampères	16,2	2 985	18	3 522
30 ampères	19,8	3 160	18	3 729

NB : la TVA au taux de 18% est facturée en sus.

TABLEAU E5 : TARIF MOYENNE TENSION

CATEGORIES TARIFAIRES	Tarifs hors TVA (FCFA)	TVA (en %) (FCFA)	Tarifs avec TVA (FCFA)
TARIF MONOME			
Puissance souscrite < 25 kW (FCFA/kWh)	110	18	130
TARIF BINOME HORAIRE			
Prime fixe annuelle (FCFA/kW)	16 806	18	19 832
Prix proportionnel (FCFA/kWh)			
Heures de Pointe (de 18 heures à 24 heures)	110	18	130
Heures Pleines (de 06 heures à 18 heures)	75	18	88,5
Heures Creuses (de 00heures à 06 heures)	55	18	65
TARIF ECLAIRAGE PUBLIC (FCFA/kWh)	110	18	130

REDEVANCE MENSUELLE POUR LOCATION ET ENTRETIEN DES APPAREILS DE MESURE ET DE CONTRÔLE

Comptage HT décompté en BT			
Location + entretien (FCFA/mois)	9 324	18	11 002
Entretien seul (FCFA/mois)	2 821	18	3 329
Comptage HT décompté en MT			
Location + entretien (FCFA/mois)	13 985	18	16 502
Entretien seul (FCFA/mois)	4 233	18	4 995

Note: prepayment not considered

Source: Data collected by the authors

Figure 54– Niger tariff decree

NOUVELLE GRILLE TARIFAIRE	
BT - Eclairage Public	
Prix de l'énergie/KWh	59,2
BT - Social (réservé aux usagers consommant moins de 50 kWh par mois)	
Prime Fixe (FCFA/Mois)	250
0-50 kWh	59,45
BT - Général Domestique 3kW	
Prime Fixe (FCFA/Mois)	1278
0-150 kWh	68,37
151-300 kWh	89,82
> 300 kWh	127,27
BT - Général 6kW	
Prime Fixe (FCFA/Mois)	2557
0-150 kWh	68,37
151-300 kWh	89,82
> 300 kWh	127,27
BT - Général 12kW	
Prime Fixe (FCFA/Mois)	5113
0-500 kWh	96,38
> 500 kWh	136,58
BT - Général 18kW	
Prime Fixe (FCFA/Mois)	7670
0-500 kWh	96,38
> 500 kWh	136,58
BT - Général 30kW	
Prime Fixe (FCFA/Mois)	12784
0-500 kWh	96,38
> 500 kWh	136,58
MT - General	
Prime Fixe (FCFA/kW/Mois)	6151
Heures de Pointe	89,19
Heures Hors Pointe	56,12
MT - Aménagements Hydro Agricoles	
Prime Fixe (FCFA/kW/Mois)	500
Heures de Pointe	65,59
Heures Hors Pointe	50,61

Source: Data collected by the authors

Figure 55– Nigeria tariff decree

Appendix: 1 Energy Charges ₦/kWh

Category	Class	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
		N/kWh	N/kWh	N/kWh	N/kWh	N/kWh	N/kWh	N/kWh	N/kWh	N/kWh	N/kWh
Residential	R1	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
	R2	16.86	24.30	24.30	24.30	24.30	31.96	33.34	32.82	32.81	33.13
	R3	27.20	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
	R4	27.20	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
Commercial	C1	20.45	36.65	37.39	37.39	37.39	48.20	50.28	49.50	49.49	49.97
	C2	27.20	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
	C3	27.20	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
Industrial	D1	20.95	35.35	36.07	36.07	36.07	46.48	48.49	47.73	47.72	48.19
	D2	27.22	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
	D3	27.22	46.23	47.09	47.09	47.09	60.79	63.42	62.43	62.42	63.03
Special	A1	20.06	35.02	35.74	35.74	35.74	46.05	48.04	47.29	47.28	47.74
	A2	20.06	35.02	35.74	35.74	35.74	46.05	48.04	47.29	47.28	47.74
	A3	20.06	35.02	35.74	35.74	35.74	46.05	48.04	47.29	47.28	47.74
Street Lighting	S1	16.56	26.84	27.14	27.14	27.14	35.29	36.81	36.24	36.24	36.59

Source: Data collected by the authors

Figure 56– Senegal tariff decree

Fourniture d'électricité en Basse tension

CATEGORIES TARIFAIRES	Prix de l'énergie en FCFA/kWh			Prime Fixe Mensuelle en FCFA/kW
	1ère Tranche	*2ème Tranche*	*3ème Tranche*	
Usage Domestique (UD)				
Domestique Petite Puissance(DPP)	90,47	101,64	112,65	
Domestique Moyenne Puissance(DMP)	96,02	102,44	112,02	
Usage Professionnel (UP)				
Professionnel Petite Puissance(PPP)	128,85	135,68	147,68	
Professionnel Moyenne Puissance(PMP)	129,81	136,53	149,24	
Usage Grande Puissance	*Heures Hors Pointe*	*Heures de Pointe*		
Domestique Grande Puissance(DGP)	86,30	120,81		869,21
Professionnel Grande Puissance (PGP)	103,36	165,38		2 607,63
Prépaiement (WOYOFAL)	*Prix de l'énergie en FCFA/kWh*			
Domestique Petite Puissance(DPP)	90,47	101,64	101,64	
Domestique Moyenne Puissance(DMP)	96,02	102,44	102,44	
Professionnel Petite Puissance(PPP)	128,85	135,68	135,68	
Professionnel Moyenne Puissance(PMP)	129,81	136,53	136,53	
Eclairage Public	118,161			3 007,21

Fourniture d'électricité en Moyenne ou Haute Tension			
CATEGORIE TARIFAIRE	Prix de l'énergie en FCFA/kWh		Prime Fixe Mensuelle en FCFA/kW
	Heures Hors Pointe	*Heures de Pointe*	
Livraison en Moyenne Tension			
Tarif Courte Utilisation (TCU)	118,51	183,48	907,32
Tarif Général (TG)	85,29	136,46	3 861,89
Tarif Longue Utilisation (TLU)	70,07	112,12	9 321,26
	Prix moyen en FCFA/kWh		
Tarif des concessionnaires d'électrification rurale	91,35		
Livraison en Haute Tension			
Tarif Général	55,69	80,20	9 461,23
Tarif Secours	74,16	106,78	4 206,24

Tranches de consommation pour les usagers basse tension (BT)			
Option tarifaire	1ère tranche	2ème tranche	3ème tranche
UD-PP	De 0 à 150 kWh	De 151 à 250 kWh	Plus de 250 kWh
UD-MP	De 0 à 50 kWh	De 51 à 300 kWh	Plus de 300 kWh
UP-PP	De 0 à 50 kWh	De 51 à 500 kWh	Plus de 500 kWh
UP-MP	De 0 à 100 kWh	De 101 à 500 kWh	Plus de 500 kWh

Source: Data collected by the authors

Figure 57– Sierra Leone tariff decree

Tariff Category	Units per kWh	Le per kWh	GST 15%	Tariff inc GST	Service Charge	GST 15%	Service Charge inc GST
		Le	Le	Le	Le	Le	Le
T-1 Residential							
Social	0-50	560	84	644	10,500	1,575	12,075
High-end	Above 50	1,415	212	1,627	10,500	1,575	12,075
T-2 Commercial	All units	1,641	246	1,887	14,115	2,117	16,232
T-3 Institutions	All units	1,526	229	1,755	14,730	2,210	16,940
T-2 Large energy users	All units	1,754	263	2,017	75,630	11,345	86,975
T-2 Welding	All units	1,811	272	2,083	39,570	5,936	45,506

Source: Data collected by the authors

Figure 58– Togo country tariff decree

I.1. USAGE DOMESTIQUE

L'usage domestique de l'électricité s'entend l'utilisation de l'électricité à des fins exclusives d'habitation dans un logement.

A. Puissance souscrite inférieure ou égale à 2,2 kVA

1. Redevance puissance : 250 FCFA/kVA / mois

2. Energie:

Tranche sociale	0 à 40 kWh	: 63 FCFA/kWh
Tranche 1	41 à 200 kWh	: 84 FCFA/kWh
Tranche 2	201 à 350 kWh	: 114 FCFA/kWh
Tranche 3	plus de 350 kWh	: 120 FCFA/kWh

3. Autres Redevances Mensuelles

Entretien Branchement	: 500 FCFA/mois
Location Compteur	: 500 FCFA/mois

B. Puissance souscrite supérieure à 2,2 kVA et inférieure à 13,2 kVA

1. Redevance puissance : 300 FCFA/kVA/mois

2. Energie:

Tranche 1	0 à 200 kWh	: 84 FCFA/kWh
Tranche 2	201 à 350 kWh	: 114 FCFA/kWh
Tranche 3	plus de 350 kWh	: 120 FCFA/kWh

3. Autres Redevances Mensuelles

3. Autres Redevances Mensuelles

Entretien Branchement	: 500 FCFA/mois
Location Compteur	: 500 FCFA/mois

B. Puissance souscrite supérieure à 2,2 kVA et inférieure à 13,2 kVA

1. Redevance puissance : 300 FCFA/kVA/mois

2. Energie:

Tranche 1	0 à 200 kWh	: 84 FCFA/kWh
Tranche 2	201 à 350 kWh	: 114 FCFA/kWh
Tranche 3	plus de 350 kWh	: 120 FCFA/kWh

3. Autres Redevances Mensuelles

Entretien Branchement	: 500 FCFA/mois
Location Compteur	: 500 FCFA/mois

C. Puissance souscrite supérieure ou égale à 13,2 kVA

1. Redevance puissance : 600 FCFA/kVA /mois

2. Energie:

Tranche 1	0 à 200 kWh	: 84 FCFA/kWh
Tranche 2	201 à 350 kWh	: 114 FCFA/kWh
Tranche 3	plus de 350 kWh	: 120 FCFA/kWh

3. Autres Redevances Mensuelles

Entretien Branchement	: 500 FCFA/mois
Location Compteur	: 500 FCFA/mois

Source: Data collected by the authors

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