Competitiveness and sustainability of electricity markets in the ECOWAS region: evolution of reforms, regulations challenge and markets integration

Dr Charly GATETE
Economist expert
ECOWAS Regional Electricity Regulatory Authority (ERERA)
cgatete@erera.arrec.org

Executive summary

Two trends have driven the evolution of electricity markets worldwide in recent decades: the liberalization of historically monopolistic markets and the integration of national markets through the creation of interconnections and power pools. This double movement has been observed in sub-Saharan Africa and particularly in West Africa since the 1990s. Indeed, African countries pursued power sector reforms from a 'standard model' advanced by development finance institutions (DFI) such as World Bank and International Monetary Fund (IMF). Under structural adjustment packages: DFI required Governments to reform strategic sectors of the economy through the separation of powers and functions and the introduction of market-based incentives. There has been a series of reforms carried out by the States to liberalize the sector. Few African countries have a wholesale or retail electricity market, and only a handful of countries have created independent grids, unbundled from state-owned generation.

This paper analyzes the process of liberalization and evolution of competitive reforms electricity sector and the construction of competitive electricity markets both at national and regional levels in the Economic Community of West African States (ECOWAS) region. The methodological approach is based on theoretical analysis of policy documents and regulations defined in the fourteen ECOWAS Member States and data analysis of secondary data collected from several databases.

The approach used is based on both theoretical analysis and analysis of policy documents, implemented regulations and secondary data to analyze completions and make the most comprehensive assessment possible of the state and evolution of electricity markets in the region.

The article is organized into three parts.

The first part of the paper describes the theoretical framework of liberalization and electricity market competitiveness. The section analyses the characteristic of competitive markets under two concepts: attractiveness and accessibility of the market. The attractiveness describes the relative potential for profitable operation in the national electricity markets, while accessibility focuses on barriers to entry, including technical barriers, regulatory barriers, and commercial and industrial barriers.

Standard market theory and contestable market theory are used to analyze the electricity market competitiveness. The contestability of the market is a key element of

competitiveness which increases competitiveness; For this, the regulator's actions should be to reduce sunk costs to facilitate entry and exit into the market; level of advertising and brand loyalty, vertical integration to open all segment of the market to competition and facilitate access to technology and skilled labour.

The second part of the paper describes the evolution of the national and regional electricity market in the ECOWAS region. It shows that the public policies and reforms in the national electricity market followed three periods from the structural adjustment programs and liberalization in 1990 under the supervision of development finance institutions (World Bank, IMF) to the beginning of liberalization policies in early 2000 to the end since 2010 the renewal of reforms towards total liberalization of the sector. ECOWAS Member States' electricity markets have progressed from monopoly to full liberalization for some of them. Most of the competitive reforms were to open the market by setting up regulations allowing third-party access to the grid, the definition of a methodology for tariff, unbundling and changing the TSO statute and the most "flagship" policy was the establishment of the authority of regulation. So, depending on the reforms implemented and the degree of horizontal and vertical integration of the market, we identify three groups of countries from the least advanced according to the implementation of competitive reforms: The first group consisting of Guinea Bissau and Gambia, is characterized by a highly concentrated market, a weak unbundling, absence of retail competition, and regulated tariffs for all consumers. The second group consisting of Benin, Burkina Faso, Cote d'Ivoire, Liberia, Mali, Niger, Senegal, Sierra Leone, and Togo; is moderately concentrated with a market partially opened and a variable degree of unbundling. In these countries, the generation segment is fully open to private industries. The third group of countries, consisting of Nigeria and Ghana are the most liberalized, with low market concentration, integrated markets, and retail competition.

After analyzing the national markets, this part presents and discusses the ECOWAS regional electricity market (REM) starting with a description of the regional power system, the interconnection plan, and the market structure. The REM structure deals with issues of phases of market development and market participants, generation technology and ownership, and financing structure. It also describes the Market architecture which consists of the map of component sub-markets in the electricity market, as well as the types of transactions and contracts driving the market. According to the market design, it is planned to have: a bi-lateral market (over-the-counter market), a spot or balancing market, a capacity market and ancillary services market. The regional regulator: ECOWAS Regional Electricity Regulatory Authority (ERERA) has set up several regulations since 2015 to develop a competitive market at the regional level.

After presenting the theoretical part and the existing situation of competitiveness of the national and regional market, the last part of the paper discusses and presents the configuration and institutional arrangement at the regional level and proposes an integrated configuration of the regional market which couples national markets into a competitive regional electricity market.

Introduction

The evolution of electricity markets around the world shows two major trends: the liberalization of initially centralized national markets that allows more competition in production and distribution and at the same time the formation of electricity interconnections or electricity pools leading to the creation of regional electricity markets. The competition that accompanies this dual development promotes electricity exchanges between stakeholders and thus makes cross-border trade between countries increasingly attractive. Therefore, this suggests, on one hand, the implementation of national regulations favorable to more competition in national markets and, on the other hand, as interconnection capacities increase, a shift from national regulation to regional regulation of the electricity market. The major challenges facing this transformation of electricity systems and markets are competitiveness and sustainability.

The objective of this paper is to analyze the process of deregulation of national markets and the construction of competitive markets within the ECOWAS region. It identifies the progress and challenges and the conditions for coupling national markets to the regional market. The article proposes some policy recommendations to increase/ensure high competitiveness and sustainability of electricity markets in the ECOWAS region. The approach used is based on both theoretical analysis and analysis of policy documents, implemented regulations and secondary data to analyse completions and make the most comprehensive assessment possible of the state and evolution of electricity markets in the region.

The article is organized into three parts. The first part of the article describes the theoretical framework and presents a literature review on the issue of the competitiveness of electricity markets. It also presents methodologies that can be used to study the competitiveness of markets in general and electricity markets in particular. The second part presents an evolution of national markets and the construction of the ECOWAS regional electricity market. It presents the various reforms undertaken in the Member States to liberalize the sector and discusses the role of national regulators. The construction of a regional electricity market in co-existence with national markets requires the coupling of the latter. Thus, the third part discusses the coupling of national markets to a regional competitive market. This part begins by presenting the challenges and gaps in terms of developing competitive and sustainable markets in the region, then presents the conditions for coupling and proposes a strategic model adapted to the region and recommendations.

1. Liberalization and electricity market competitiveness

This first section proposes a theoretical view of the issue of liberalization and reforms in the electricity sector and the competitiveness of electricity markets.

1.1. Competitiveness in liberalized electricity markets

Liberalization is the process of removing government control and regulations to create markets for competitive entities. In the electric power industry, liberalization refers

primarily to creating new regulatory structures to ensure independence; and introducing competition in:

- Generation sector (as opposed to the transmission and distribution wires business), and
- “Supply” sector (aggregators) to offer supply directly to retail customers, varying from large commercial & industrial through to residential end-use customers
- Recent trends introduce P2P with distribution-level embedded generation transacting through trading platforms (blockchain)

Competition in these sectors of the industry is thought to allow lower cost investment and operation compared to regulated integrated utility services.
In liberalized markets, four kinds of products can be traded: transmission service by some owners of transmission lines; energy which is the main product sold to consumers; capacity in MW by TSO and ancillary services generally proposed by TSO or SMO.

Table 1: Electricity Products in Liberalized Markets

Products	Description
Transmission	–Service that allows integrations of loads and generating resources using high-voltage transmission facilities –Monopoly service sold at regulated rates
Energy	–Output of generating resources to serve load –Sometimes sold forward in bilateral contracts, day-ahead markets, or intraday markets
Capacity	–MW capability of a unit standing ready to meet planning obligations
Ancillary Services	–Services necessary in support of the transmission of electric power between generation and load, maintaining a satisfactory level of operational security and with satisfactory quality of supply. They include: 1)Active power reserves for balancing 2)Other: e.g. Reactive power for voltage support/Black start /Islanding capability.

This section on the competitiveness of electricity markets views market liberalization reforms through the lenses of market rules and institutions, market structures and price formation. It analyses the characteristic of competitive markets with the concepts of market attractiveness and market accessibility as the core analytical foci.

The concept of 'attractiveness' describes the relative potential for profitable operation in the national electricity markets, which would determine the companies' and the traders' selection of foreign markets for entries. More specifically, the attractiveness of markets is analysed as their business potential in static terms (market size) and dynamic terms (market growth and price differentials).

The concept of market accessibility focuses on barriers to entry, including technical barriers (interconnection capacity, number of entry points), regulatory barriers (deterring rules of access), and commercial and industrial barriers (in particular the positions of incumbents, the potential opportunities to acquire firms). On this point, market accessibility is shaped by the performances of regulatory frameworks.

The assumption is that on the one hand, the market developments will depend on business potential in each national market, resulting from market size and market growth. On the other hand, market developments depend on the opportunities for entry defined by the new regulatory regime. The accessibility of each market is viewed either for contractual sales or company acquisition and conversely, the possibilities offered to incumbents for preserving their dominant position and deterring entries. Besides the regulatory framework, the accessibility of the markets is partly conditioned by the incumbents' position- a high level of market power among existing generation and supply companies is generally associated with the absence of a marketplace, which impedes new entrants.

Table 2: Characteristics of competitive markets

ATTRACTIVENESS		ACCESSIBILITY	
Size	Overall, segment	**Technical accessibility**	Interconnections, internal congestion
Growth	By segments • Industrial • Commercial • Power generation, etc.	**Regulatory accessibility**	Degree of openness: • Type of TPA • System operation unbundling • Transmission pricing • Regulatory institutions
Profitability	Price level	**Commercial accessibility**	Wholesale price index exchanges: • Bourses • Hubs • Pools
		Industrial and capital market accessibility	• Balancing market • Horizontal integration • Vertical integration (production/import-supply) • Regime of ownership

1.2. Electricity market analysis through Standard market theory and the contestable market theory

Before discussing the evolution and integration of national electricity markets, this part proposes a literature review on the competitiveness of electricity markets. This analysis is based on market theories.
We supposed the following two basic conditions or hypotheses: technical infrastructures for the trade, regulation and market rules are implemented; and industrial structures determine the effectiveness of the competition and the market efficiency, via the possibility of balancing dominant firms' market power in the oligopolistic game.

Two concurrent theories of market theory are used to characterize the competition profile of the different national markets: the standard market theory and the contestable market theory.
Concerning standard market theory, the competition must imply several producers and suppliers in competition on the different levels of the value chain, under the hypothesis that the structure determines the players' conduct and the efficiency of the markets

(Armstrong *et al.,* 1994; Newbery, 2001). In this case, in the electricity industry, conditions of competition are the following:

- The competitive activities- power generation, import on the upstream side; wholesale and retail supply on the downstream side- must be horizontally de-integrated among a significant number of market players. This means that in part of each value chain, there are several players. For example, several IPP, many wholesale or retail suppliers, etc.
- The organisation of the interface between the regulated and competitive parts of the chain of activities must limit the exercise of market power by incumbents. Given the technical peculiarities of the energy networks and the consecutive necessity of technical coordination by the system operator, the risk of market power exercised by the operator suggests separating the competitive activities from the transmission system operation, it is not the case in telecommunications where such a technical source of market power does not exist.
- Vertical integration between generation and supply under a hierarchical structure (or long-term contract) must be limited to reduce entry barriers. For these authors, horizontal concentration and vertical integration between upstream and downstream activities could be preserved if nondiscriminatory access to the respective grids is guaranteed to the incumbents' potential competitors with a complete unbundling of the networks which could be justified in this sense. From this point of view, in the electricity and gas industries, it would be sufficient to have credible threats exerted under these conditions by the foreign competitors which are themselves incumbents in the adjacent national markets, that avoid divestitures of the incumbents' production assets.

The theory of contestable markets (Baumol et al., 1982), insists upon the technical and jurisdictional conditions of credible competitive threat and virtual competition rather than the structural conditions. It opposes its conclusion to the competitive model by considering that the main objective of competition could be simply reached by suppressing the legal and technical barriers to entries. In essence, a contestable market is one with firms facing zero entry and exit costs. This means there are no barriers to entry and no barriers to exit, such as sunk costs and contractual agreements. So, the existence, or absence, of sunk costs and economies of scale are two significant determinants of contestability. Based on these two criteria, natural monopolies as the electricity market before the liberalization are the least contestable markets.
With no barriers to entry into a market, it can be argued that the threat of entry is enough to keep incumbents ‘on their toes. This means that even if there are a few firms, or a single firm, as with oligopolistic and monopolistic markets, a market with no barriers will resemble a highly competitive one. In this case, the competitiveness of a monopolistic or oligopolist electricity market depends on the openness of the market. We can agree that an electricity market where private producers can enter and exit without barriers/ sunk costs to produce and sell power, or a market with several distributors can be appreciated as a competitive electricity market to a certain degree. In practice few markets are perfectly contestable, however, there are degrees of contestability. With lower barriers to entry and exit, the market will be more contestable. Contestable markets are likely to have competitive prices (Wilkens, S., Wimschulte, J., 2007) and profitability and respond to the public interest. Indeed, a contestable market can bring the benefits of competitive markets such as:

i) Lower prices (allocative efficiency)
ii) Increased incentives for firms to cut costs (x-efficiency)

iii) Increased incentives for firms to respond to consumer preferences (allocative efficiency)

However, there could also be significant economies of scale because the theory of contestable markets doesn't require there to be 1000s of firms as is the case in the electricity market.

Therefore, policymakers and regulators should not just look at the degree of concentration, but also the degree of contestability and how easy it is to enter the market.

Regulators in the privatised industries have often focused on removing barriers to entry, rather than breaking up big firms to avoid big firms to have market power which is counterproductive for competition in the market. So, the contestable market theory has influenced the views and methods of regulators. Opening a market to potential entrants both producers and distributors may be sufficient to encourage efficiency and deter anti-competitive behaviours. For example, regulators may force incumbents to open up their infrastructure to potential entrants or to share technology – as in the case of telecommunication and broadband operators being allowed to use the incumbent's existing infrastructure. It was the case in France in 1997 when the regulator forced the national TSO: RTE (electricity transmission network) to allow new entrants to use its infrastructure and grid.

These examples show also that competitiveness and contestability of the electricity market increase through the regulator's actions to limit barriers to exit or entry into a market. We can identify four factors which determine the contestability of a market. There are:

2. **Sunk Costs:** If sunk costs are high in a market this makes it difficult for new firms to enter and leave. Therefore, the market will be less contestable. For example, if a new firm builds a generator plant (power plant), that it wouldn't be able to resell on leaving the market, this may act as a deterrent. Sunk cost in the electricity market is usually high because of the high costs of the assets (power plant, transformer, transport lines, etc.). This is the main factor which makes the electricity market less contestable.
3. **Levels of advertising and brand loyalty.** In some markets, if an established firm has significant brand loyalty such as Coca-Cola, Nike or Facebook, then it will be difficult for a new firm to enter the market. This is because they would have to spend a lot of money on advertising which is a sunk cost. Even if they spend money on advertising it may not be sufficient to change customer loyalty to very strong brands. It depends on the industry; customer loyalty would be low for a product like petrol because it is quite homogenous. But, for soft drinks, people have a greater attachment to their 'brand'. These factors don't affect the electricity market because of the homogenously of the product: electricity. However, the process of green certificates or labels awarded to a unit producing electricity from renewable energies can be perceived in a certain way as a form of product differentiation.
4. **Vertical Integration** If a firm does not have access to the supply of a good then the market will be less contestable. For example, Oil firms could restrict the supply of petrol-to-petrol stations, making it difficult for new firms to enter. Regarding electricity market, if you wish to sell electricity to domestic customers, a big issue is whether you can gain access to the electricity grid. Indeed, generally, the national electric grid is a natural monopoly, but government regulation can make sure firms have fair access to the grid. Giving access to different stages of production can make the market more

contestable. This is what happened thanks to the reforms in the European electricity markets which made it possible to increase market competitiveness (Wilkens, S., Wimschulte, J., 2007) by opening the distribution segment to competition (Glachant, J.M. and Finon, D. Eds. 2003; Mohr J. 2018).

5. **Access to technology and skilled labour.** In some markets or industries like electric car production, it is difficult for new firms to have the right technology. In other markets aircraft producers, they require skilled labour that is difficult to get. This makes these markets less contestable. This factor affects the electricity market less, except for nuclear industries which also require a more qualified workforce than in other power plants.

The energy sector reform took a special place in the state support system of the producers. The development of the energy market, based on the openness of the market (entry and exit), the implementation of competitive pricing mechanisms and the formation of the institutions of open energy trading, is one of the necessary conditions for the competitiveness and efficiency of energy markets in standard and contestable market theories. A competitive market environment formation was identified as one of the main priorities for energy sector development and electricity market liberalization was seen as an essential condition necessary to guarantee competitive tariffs for energy products for consumers. the following part proposes a discussion on the liberalization of electricity markets and their impact on competitiveness.

1.3. Competitiveness and market power in the electricity market

Market power in the electricity auction markets is defined as the ability of a buyer or seller to alter the market price significantly and sustainably from the competitive price. Most economists interpret the competitive price as the market price that results when sellers are willing to offer power at their marginal opportunity cost and buyers bid for power at their true willingness to pay. The general economic principle is that the larger the number of sellers and buyers, the more likely that market prices and quantities will be competitive. This principle is measured through indices of market concentration or by market price simulations. Since there are currently few price-responsive buyers in electricity spot markets, the auction price is usually set by sellers (except when administrative scarcity pricing is enforced). Hence, the competitive price is typically estimated or simulated based on known production costs of the marginal unit delivering to a location, primarily fuel costs, and, if possible, adjusted to account for short-term fixed costs (such as start-up) and inter-temporal opportunity costs (for limited energy plants, such as hydro or emissions-constrained facilities). When the market price is above this competitive price, which it usually is, then some degree of supplier market power is being exerted. In economic terms, consumer surplus is being transferred to producers and the total producer surplus is being shifted among suppliers. The task of the regulator is to determine whether and how to manage such market power such that a reasonable approximation of competitive market prices and quantities prevails. According to Mohr J. (2018), the legal and regulatory methods for doing so vary between countries and supra-national organizations, such as the European Union. In the United States, FERC has the

statutory obligation and authority to mitigate the market power of sellers and buyers in the wholesale electricity markets under its jurisdiction.

As indicated below, market power is one of the critical issues of competitiveness in electricity markets. After the liberalization of electricity markets, this issue of market power was controversially discussed in many countries. After the California energy crisis in 2001 and 2002, there was an academic debate, for example, Borenstein et al. (2002); Joskow and Kahn (2002); Puller (2007); Bushnell et al. (2008) concerning the wholesale electricity market in California started (Fabra, N., von der Fehr, N., and Harbord, D. 2004). These papers are empirical studies and find indications of the abuse of market power during this crisis (Helman, U. 2006). They show that this abuse of market power has affected market competitiveness and worsened the crisis. Other academic papers analyzed other liberalized markets in the US. It is, for example, Bushnell and Mansur (2008) study the effect of vertical integration of generators and retailers on market competitiveness in Pennsylvania, New Jersey, and Maryland market (PJM) finding that integration increases competition and that the restructuring of PJM's electricity market leads to an increase in anti-competitive behaviour by large net sellers. All his studies highlight the importance of fighting against market power in building and maintaining competitive electricity markets. To do this, market monitoring and surveillance are key activities to be implemented by manufacturers/ market regulators to guarantee market competitiveness.

2. Evolution of National and regional electricity markets in the ECOWAS region

Electricity has been historically provided by vertically integrated geographic monopolies, where all four segments of electricity supply – generation, transmission, distribution, and retailing – are provided by the same company. In most developing countries like the ECOWAS countries, these monopoly electricity suppliers are owned and operated by the state, subject to government oversight, through the relevant ministries. In this arrangement, costs are recovered through a regulated rate of return. In many developing economies, there has been a shift from this traditional model to a deregulated model, which involves the unbundling of the vertically integrated monopoly into the functional segments of the industry, the introduction of competition in the generation and supply segments and the introduction of open third party access to the networks, to better meet the rapidly growing power demand, improve supply reliability, achieve better economic efficiency and reduce total system losses and costs.

The progressive implementation of these reforms has led the national electricity market of ECOWAS Member States on the path of liberalization and competitiveness.
This section presents in the first part, a comparative analysis of the various reforms in the ECOWAS countries and the evolution of the construction of competitive markets. The second part presents the construction of the ECOWAS Regional Electricity Market (REM).

2.1. National electricity markets reforms and role of regulators in ECOWAS Countries

Public policies and reforms in national electricity markets

Following Eberhard, Anton and Catrina Godinho, (2017), we can identify three periods in the evolution of electricity sector reforms in ECOWAS countries.

Period 1990: Structural adjustment programs and liberalization of the sector

In the early 90s, development finance institutions (DFIs), including the World Bank (WB) and the International Monetary Fund (IMF), offered countries conditional loans linked to structural adjustment requirements, which encouraged economy-wide liberalization, commercialization and restructuring. In particular, they have offered some government financing linked to reforms in the electricity sector to adopt the "standard model" to deal with corporate failures (Eberhard, A., and K. Gratwick. 2008).

The reform elements of the "standard model" promoted by DFIs recommended the following:

• the marketing of electricity companies and the privatization of their management;

• the restructuring of national monopoly companies to unbundle generation, transmission and distribution services;

• the creation of an independent regulatory system and the adoption of cost-reflective electricity tariffs;

• opening up the sector to private sector participation (PSP); and

• the introduction of competition into the market through large-scale acquisitions, to eventually ensure full competition for wholesale and retail customers.

The "standard model" reforms have targeted all segments of the electricity value chain in Africa in very different ways.

Power companies have undergone restructuring efforts in many countries to streamline incentives and improve operational efficiency by decoupling generation, transmission and distribution. Most countries have established regulatory entities to oversee the licensing of operators in the sector and to regulate tariffs and pricing. Private capital has been introduced, to a large extent, on the generation side, which can easily accommodate independent power producers (IPPs) to build new power plants and connect to the national grid. Many countries have also experimented with other forms of private sector participation, including concession contracts for the benefit of a private entity to manage the electricity company. Competition for the purchase of additional power generation capacity has been mainly through the auction of IEPs.

However, the implementation of the structural adjustments proposed under the Standard Model could not always take into account local concerns, visions and needs or could not be understood by national stakeholders in the sector, so the logic and results resulted in low levels of ownership and support for measures at the local level. The result of this first period of reform remains mixed with state electricity companies which remain for the majority vertically integrated with financial difficulties for several of them due to partial privatization. The unfinished process of liberalisation of the sector has also been accompanied by the preparation of numerous ambitious policy documents and strategies by the Member States. At this level too, two families of national policies and/or strategies can be identified. For the majority of Member States, this involved the preparation of Political Letters which defined the political will of the States in terms of the development of the sector and its interaction with other economic sectors.

Period 2: Liberalization policies in early 2000

Following the process of liberalization of economies on a global scale through the GATT negotiations and the creation of the WTO, African countries and those of the ECOWAS region in particular continued reforms undertaken in the 90s for the liberalization of the sector. After the SAP and the incomplete reforms of liberalization of the sector, the new wind of development through the formalization of development strategy and economic liberalization of States has resulted in the electricity sector by an acceleration of reforms for the complete liberalization of the sector. One of the flagship reforms of this period is the creation of regulatory structures in the Member States. The establishment of an independent regulatory authority aims to create rules-based fair competition for producers, consumers, and private operators in the electricity sector through clear rules and mechanisms for supervising the sector and tariffs reflecting costs for companies.
Independence from the state and other interests remains an issue for many electricity regulators in Africa, limiting their ability to effectively carry out their regulatory functions.

In addition to the creation of regulatory authorities, opening up Africa's electricity sector to capital investment flows is often a backstop to reform objectives. IEPs are the fastest-growing private sources of investment in this sector, alongside projects funded by traditional international donors. However, it must be recognized that the transportation segment has not benefited from the same influx of private investment as the production segment which has proven to be the most open or competitive part of the sector. Only a few countries benefit from some form of private sector involvement in transport (Ghana and Nigeria). Private management has been introduced in the form of concessions, leasing and comprehensive privatization programmes for parts of the electricity sector in several countries.

African countries have largely retained the traditional structure of integrated monopoly companies in their electricity sector, although most have integrated IEPs.
Other countries are considering the possibility of restructuring and establishing an independent system operator to assume responsibility for planning generation, purchasing electricity, operating and transporting electricity, and planning for the transmission and distribution of electricity at a lower cost. Thus, countries such as Nigeria, Ghana and Senegal, which have undertaken important reforms, rank higher than others.

The reforms conducted during this period were generally designed to achieve the following goals:
- Enhance the performance of the state-owned utilities concerning inadequate expansion, access to electricity and poor quality of service delivery.
- Permit private sector participation in the sector.
- Allow charging of cost recovery prices.
- Ensure adequate capital outlay to prevent deterioration of infrastructure.
- Promote energy conservation and efficiency.
- Encourage interconnection to neighbouring countries, as a way of reducing the high cost of supply.

Reforms have brought about energy market liberalization and the establishment of national legislative and regulatory frameworks to facilitate private sector participation. One of the major achievements of such reforms was the introduction, albeit on a limited scale thus far, of independent power producers (IPPs) and independent power distributors (IPDs).

Reforms involved changes in structure, ownership, and management. Structural changes concerned the process of unbundling vertically integrated utilities into separate generation, transmission and distribution entities (vertical unbundling), or unbundling large national utilities into smaller utilities (horizontal unbundling).

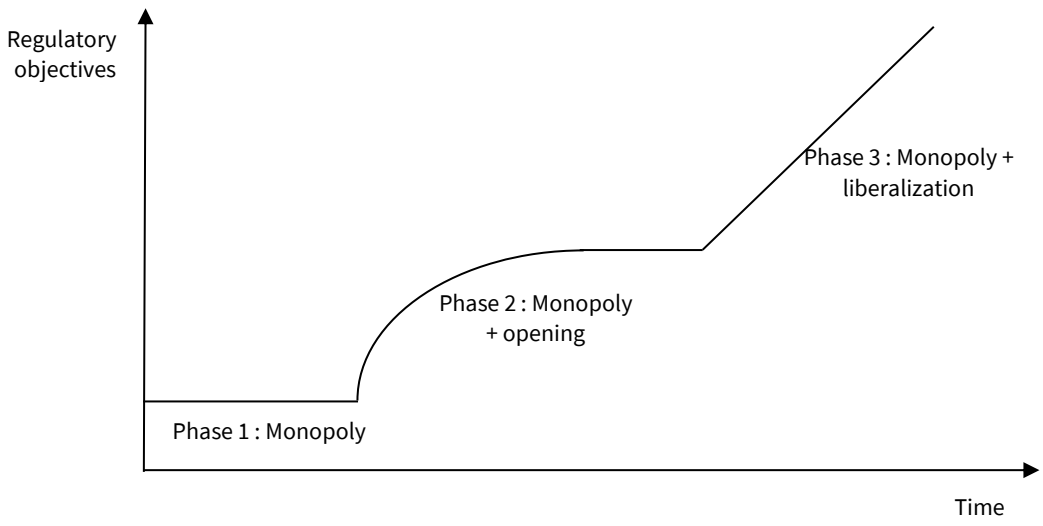
Period 3: the renewal of reforms towards total liberalization of the sector

With the establishment of the West Africa Power Pool in 2000 with a mission to develop a sustainable interconnected regional electricity supply system to promote the economic growth of the ECOWAS region, several reforms were initiated by the ECOWAS Member States to accelerate the liberalization of the sector. The ERERA created in 2008 with the mission to regulate cross-border electricity exchanges between ECOWAS Member States, is a key in the elaboration and implementation of regulation for the development of the regional market, encourages and assisting the Member States in the harmonization and acceleration in the implementation of reforms for market liberalization. There was then a review of reforms that were accessed on:

1. Allow access to the third party to the national network
2. Unbundling from production activities to distribution
3. Accounting separation for vertically integrated operators
4. Opening up all segments of the value chain to competition
5. Fostering the integration of renewable energy into national and regional markets
6. Fostering private investment in the sector's value chains

From the above analysis, we can map the evolution of reforms and regulatory objectives according to the following figure.

Figure 1: Different periods in reforms and regulatory objectives



Since the first period of the monopoly of public services of the State on the whole value chain of the sector, the policies and regulations put in place have been aimed at protecting the strategic electricity sector, preparing operators for liberalization and building the opening of the market to competition.

Phase 2 is the period of coexistence between the persistent monopoly of public operators and the entry of new players into the sector, particularly in the generation segment, thanks to reforms. Competition within the sector is gradually increasing.

Phase 3 is the period of acceleration of liberalization reforms to ensure fair trade practices and actions.

Mapping the competitive reforms

In a competitive electricity market, where any party selling or buying electricity connects to and makes use of the transmission network, regardless of who owns and operates the power grid, network regulation encompasses two dimensions: access and pricing. Many reforms have been implemented in Member States for competitiveness through reforms on these two dimensions. According to EC-DG Tren (2003), several factors of competitiveness can be used to asset and compare the competitiveness and the status of development of different national markets in the ECOWAS region.

i) *Market opening (Third party access):* the opening of the market both for entry and exit is an unconditional factor for market liberalization and competitiveness. This was not the case in the electricity market which was dominated by public utilities some years ago. The different reforms in these monopolistic electricity markets allow third-party access to one or more segments of the market. To achieve non-discriminatory network access, it is generally required that the formerly vertically integrated electric utilities unbundle at least their accounts respecting network operation and any other activities. For the transmission level, the System Operator (SO) must ensure non-discrimination access to the network between the incumbents and new entrants (Laffont and Tirole 1996). Third-party access to the grid in the transmission or distribution segment is the actual most critical issue in ECOWAS countries' electricity markets. The third-party access can be regulated by a regulator or negotiated between the third party and the Transmission System Operator (TSO).

ii) *Type of transport tariffs:* There is two main classes of network pricing according to Crampes and Laffont, (2001):

-The first class is related to the open market model where payment at one point gives access to the whole network. The point of connection tariff could be nodal, that is, linked to the costs of producing electricity, or based on the accounting costs of assets.

- the second class is related to the transportation model where tariffs are related to distance. In this class for instance, in the contract path, entry and exit points are specified and the price refers to the cost of the assets on the agreed transmission path.

Within this double classification, transmission tariff methods can be classified into two categories:

- cost-based methods which are methods driven by transmission investment costs. We can find in this category the following methods:

1. postage-stamp
2. contracts-path
3. Point-to-point MW-Km or MW-mile
4. Investment coast-related network pricing (ICRP)
5. Area of influence and tracing methods

In this category of methods, postage stamps and MW-Km of MW-mile are the most widely used solutions.

- value-based methods, which are driven by generation costs
  1. zonal prices
  2. short-run marginal cost (SRMC)
  3. Long-run marginal cost (LRMC)

In this category of methods, the zonal princes are the most used solution.

iii) *Unbundling and TSO status:* The level of unbundling in the market and the TSO status can affect the degree of competitiveness in the market. We agree that unbundling each segment of the market in the vertically integrated market or at least the unbundling of TSO accounts with respect to network activities allows us to guarantee minimum marginal cost and competitiveness in each segment of the market. This level of unbundling and TSO status can be Independent when it is fully unbundling, subsidiary when it is partially unbundling with accounting separation, or starter when the TSO is fully vertically integrated without accounting separation,

iv) *Standard balancing obligation:* this point explains at which level the balancing measures are fixed: hourly, daily, etc.

v) *Authority of regulation:* Regarding this point, the status and the power of the regulatory authority are important to guarantee that all necessary conditions (market rule, market design, procedures, etc.) are well elaborate for market competitiveness. This authority can be a consultative body, specialized ministerial division, or independent institution with full power. This can be determined by analyzing the institutional anchoring of the regulator.

We use this classification to compare and map the competitive reforms in the ECOWAS Member States.

Table 3: Mapping of the competitive reforms in the electricity sub-sector in ECOWAS countries since 2000

	Third-party access	Type of transport tariffs	Unbundling and TSO status	Standard balancing obligation	Authority of regulation
Benin	No Regulated		starter	Daily	Consultative body
Burkina Faso	No Regulated		starter	Daily	Independent institution
Cape Verde	No Regulated		starter	Daily	Consultative body
Côte d'Ivoire	Regulated	Nodal / Zonal pricing	Independent	Hourly	Independent institution
The Gambia	No Regulated		subsidiary	Daily	Independent institution
Ghana	Regulated	Nodal / Zonal pricing	Independent	Hourly	Independent institution
Guinea	No Regulated		starter	Daily	Consultative body
Guinea Bissau	No Regulated		starter	Daily	Yes (specialized ministerial division)
Liberia	No Regulated		subsidiary	Daily	Independent institution
Mali	No Regulated		starter	Daily	Independent institution
Niger	No Regulated		starter	Daily	Independent institution
Nigeria	Regulated	Nodal / Zonal pricing	Independent	Hourly	Independent institution
Senegal	Regulated	Nodal / Zonal pricing	Independent	Hourly	Independent institution
Sierra Leone	No Regulated		subsidiary	Daily	Independent institution
Togo	No Regulated		starter	Daily	Consultative body

Countries differ concerning their commitment to, and faith in, competition, which appears to have an important impact on the extent to which effective competition is created. Table 3 Mapping of the competitive reforms in the electricity sub-sector in ECOWAS countries since 2000. We can classify three groups of countries according to the implementation of competitive reforms.

The first group consisting of Guinea Bissau and Gambia is characterized by a highly concentrated market and a near monopoly of the incumbent. There is a weak unbundling, an absence of retail competition, and regulated tariffs for all consumers. This group concern the small countries, which have low incomes, and underdeveloped institutional framework, whose size limits the options for competition.

In the second group, the market is moderately concentrated. Most countries have opened their markets partially, but the degree of network unbundling varies and, in some cases, price regulation is applied. These countries are characterized by the fact that their generation segment is fully open to private industries. This group consists of Benin, Burkina Faso, Cote d'Ivoire, Liberia, Mali, Niger, Senegal, Sierra Leone, and Togo.

The third group of countries, consisting of Nigeria and Ghana are the most liberalized, with low market concentration, integrated markets, and retail competition. These countries have deliberately chosen, on an ideological basis, to liberalize their power systems, by dismantling their former monopolies and restructuring their industries.

Electricity sector structure and unbundling process in the electricity market

Before liberalization, the electricity supply chain had around four functions under a monopoly structure. It was structured
- *Production* involving the transformation of primary energy into electricity.
- *Transmission* involving high voltage transport of electricity to the distribution level.
- *Distribution* completing transmission at the lower voltage to the end user.
- *Supply* representing the retailing of electricity to end users (in a monopolistic situation this function is generally aggregated into distribution).

This type of industrial structure built around an integrated and coherent value chain is strongly subjected to vertical and horizontal integration. Vertical integration is linked to transaction characteristics such as asset specificity, externalities, and measurement problems (Glachant and Finon, 2000). Asset specificity refers to the fact that production must be continuously linked to the end-user (site specificity) and that as a non-storable good, the electricity flow must be unbroken through the supply chain (time specificity). These two factors favour vertical integration. The natural monopoly situation in transmission and distribution reinforces vertical integration with production, as both cost functions can be interdependent. Finally, externality and measurement problems refer to the need for a 'system's operator', responsible for the maintenance of the stability of the network. This network management function usually serves as a cooperation mechanism between the actors of the systems. Complete vertical integration of the system thus reduces transaction costs.

Horizontal integration in a monopolistic situation mainly depends upon economies of scale and scope, path dependency factors such as the historical heritage, the political structure and the legal order regulating the sectors in terms of ownership.

The structure of the ownership is generally considered to be the third important dimension of industrial structure analysis. The following table presents the current situation in the ECOWAS Member States.

Table 4: ECOWAS Electricity sector structure

	Degree of horizontal integration			Vertical integration
	Production	Transmission	Distribution	
Benin	Moderate	Low	Moderate	High
Burkina Faso	Moderate	Moderate	Moderate	High
Cote d'Ivoire	Moderate	Moderate	Moderate	Low
The Gambia	Moderate	High	High	High
Ghana	Low	Low	Low	Low
Guinea	Moderate	High	High	High
Guinea Bissau	High	High	High	High
Liberia	Moderate	Moderate	Moderate	High
Mali	Moderate	Moderate	Moderate	High
Niger	Moderate	High	High	High
Nigeria	Low	Low	Low	Low
Senegal	Low	Moderate	Moderate	Low
Sierra Leone	Moderate	Moderate	Moderate	High
Togo	Moderate	Moderate	Moderate	High

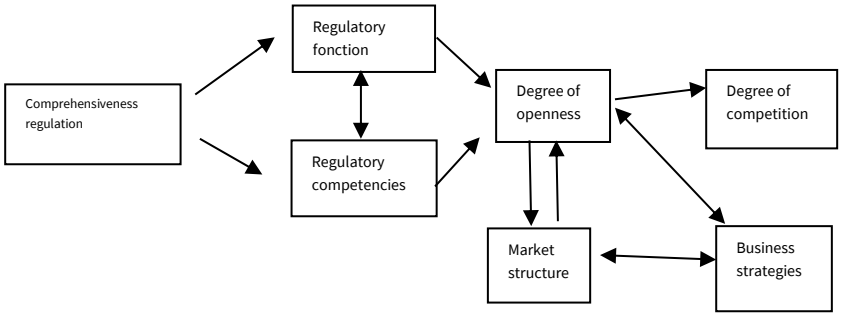
This table shows that most of the countries are highly vertically integrated except Cote d'Ivoire, Ghana, Nigeria, and Senegal where regulations allow third-party access and the sector is unbundling. Regards horizontal integration, countries have different degrees of integration according to the regulations countries took to allow competition in the

production, transmission, or distribution segment. Only Ghana and Nigeria have a low degree of horizontal integration in all segments because they open all their electricity sector to competition.

How regulation changes impact the degree of competitiveness

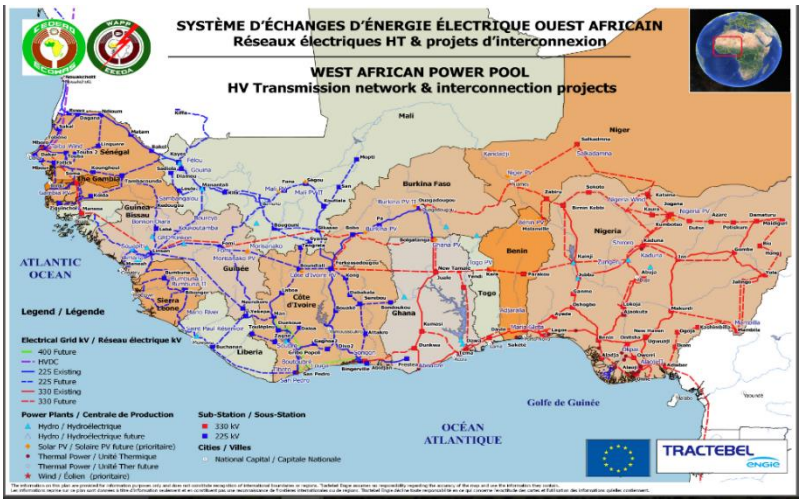
All ECOWAS Member States came from a system of monopoly regulation and close national electricity markets, and this too contributed to the regulatory variation. With Bergman and all. (1998), regulation matures in congruence with the transition from monopoly to competition, assuming a clear mutual and reciprocal relationship between regulation on the one hand and changing market structure and business strategies on the other. In this perspective, the development of the regulatory function in the electricity market is a dynamic process in which regulation, market structure and market behaviour jointly determine the next steps in the process. In this process, the regulatory changes initiated by the various regulations can be considered as a first, necessary, step only. The figure below shows that the comprehensiveness of regulation implies regulatory functions and competencies to ascertain the openness of electricity markets. The degree of openness in its turn is a basic condition for the degree of competition. But as the figure shows, competition is not only influenced by regulation but also by (changing) market structure and business strategies.

Figure 2: Factors influencing the degree of competitiveness of electricity markets.



2.2. Regional electricity market and role/actions of the regulator

ECOWAS Regional Electricity Market Background



ECOWAS Master Plan for the Development of Regional Means of Electricity Generation and Transmission 2019-2033

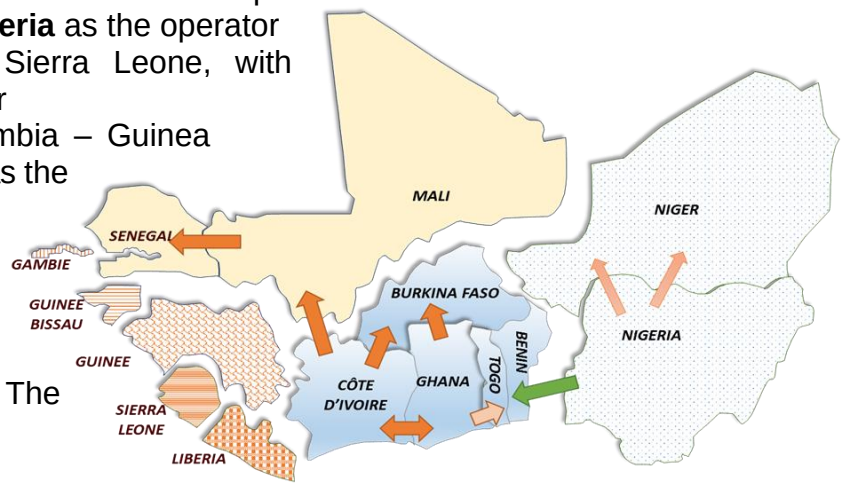
The ECOWAS Regional Electricity Market (REM) consists of the regional power system and the arrangements that enable the sale and purchase of power among Sellers and Buyers in the region. The regional power system is a combination of power plants producing electricity (i.e., generators), high-voltage substations and power lines

transforming and transporting bulk electricity around and through the ECOWAS Member countries (i.e., the transmission system) and medium-/low-voltage substations and lines transforming and delivering electricity services to individual homes and businesses (i.e., the distribution system). Currently, generation, transmission, and distribution services in most ECOWAS countries are provided by regulated, vertically integrated utilities. In addition, some of the national networks are physically connected with neighboring country systems to allow electric power to be imported and exported across national borders, as appropriate. The regional transmission system is operated by the West African Power Pool (WAPP), which is a group of utilities and power companies established in 2000.

The regional power system is composed of 9 Member States that are electrically interconnected but operating as five synchronous or control areas due to system stability issues. The Control Areas (CAs) are groups of the segments of the national power systems of the ECOWAS Member States, established to be part of the Regional Market Institutions for operational purposes. The Control Areas do not take part in the commercial aspects of trading in the region. They are independent of the buyers and sellers in the market and must not discriminate in the dispatch operations. The key responsibility of the Control Area operator is to coordinate operations with the Domestic Transmission System Operators (DTSOs) in their Areas in such a way that the flows in the interconnectors with other Control Areas are maintained according to schedule. In line with the provisions of the WAPP Operation Manual, the five such Control Areas are:

- Côte d'Ivoire-Burkina-Faso, with **Cote d'Ivoire** as operator
- Ghana-Togo-Benin, with **Ghana** as the operator
- Nigeria-Niger, with **Nigeria** as the operator
- Guinea – Liberia – Sierra Leone, with **Guinea** as the operator
- Senegal – Mali – Gambia – Guinea Bissau, with **Senegal** as the operator

Notice that 5 Member States are electrically isolated from the other members: Liberia, Sierra Leone, Guinea, The Gambia, and Guinea-Bissau**.**



Map of WAPP Synchronous Network

But according to WAPP Master plan, two interconnections' lines are in the pipeline

- <u>CLSG Project interconnection lines</u>: which is an interconnection line of 1,357-km-long double circuit high voltage (225 kV) line to connect the national networks between Cote d'Ivoire, Liberia, Sierra Leone and Guinea. The commissioning is planned for 2021-2022.
- <u>OMVG Project interconnection lines</u>: this is an interconnection line between of 1,357-km-long double circuit high voltage (225 kV) line to connect the national networks of the four countries: The Gambia, Guinea, la Guinea-Bissau and Senegal. The commissioning is planned for 2021-2022.
- <u>North core</u>: it is a green-field regional project designed to build 880 km of 330 kV transmission lines in sections separately owned by three members' country

Over the past few years, the electricity sectors of some of the ECOWAS countries have started the process of restructuring. Also, the regional electricity market has been set up to develop in phases according to the market design plan. With the restructuring of the utilities and the development of the ECOWAS regional electricity market, it is expected that electricity will be purchased through a competitive wholesale market operated by a regional system market operator (SMO) for the region, and a market operator (MO) for each participating country. The SMO/MO function under market participation agreements with system participants, including distribution service providers and transmission owners. These agreements are approved by, and will continue to be overseen by, the national regulatory authorities (NRAs) for the national markets and the regional regulator, ERERA, for the regional market.

Currently, power transactions are based on bilateral contracts between utilities in the Member States. According to Resolution EEEOA/292/RES.21/10/20 – the list of market participants is composed of TSO (14) and PPAs holders namely eight sellers and five buyers. There are fifteen PPAs between market participants for a total of 6,0 TWh annually. This represented 2019, 8.3% of energy generation.

The slow evolution of regional trading is mainly due to a lack of transmission links and a shortage of generation capacity. Adequate transmission capacity to interconnect between countries and within the power systems of each country is needed to encourage effective regional trading.

- *Generation*

The installed generation capacity of the ECOWAS power system is approximately 24,073.1 megawatts (MW), contributed by the Member States. There is no provision for a reserve margin in this generation capacity, as there is still a capacity shortfall in the region. The Reserve margin is the amount of electric generating capacity that exceeds the projected peak demand for electricity. In some countries, the actual power consumption is less than the installed generation capacity because of network constraints, e.g., Nigeria.

- *Transmission System*

The transmission system in the region consists of the interconnection of substations and high-voltage lines. The transmission voltages in the region range between 66 kV and 330 kV but the regional transactions concern range below 125 kV. The national and regional power systems consist of many load centres and electricity supply sources connected by transmission facilities. At times, load demand, generation supply, and transmission facilities interact to impede the free flow of power, a condition referred to as congestion. Congestion is a feature more common in national networks than in regional interconnections.

- *Distribution System*

The distribution systems throughout the region are designed either as radial or loop networks. A radial distribution network consists of several primary circuits extending radially from interface substations connected to the power transmission system. Each circuit serves customers within a particular area, and the failure of a circuit would normally mean a loss of supply to the customers on the circuit. A loop system is most frequently found in high-load density metropolitan areas of the region. With multiple feeds on the loop, most customers would not be affected by failures of a circuit.

The entities in charge of power distribution services own the wires and circuits to most customers, respond to customers' requests for service and maintenance, and they also provide the bulk of the metering and billing services.

After the presentation of this background of the regional electricity sector, the following parts present the regional market structure, architecture and governance, and then it presents regulations implemented for market competitiveness.

Regional electricity Market (REM) Structure

Market structure refers to the properties of the market closely tied to technology and ownership. It has to do with the numbers, sizes, and relationships of the firms in the market. It also refers to the physical system of the market (generation, transmission, distribution) and the arrangement for service provision. Market structure has a decisive impact on market power and investments. The more participants, the fewer incentives for market power and the more competition and investment inflow.

The electricity utilities of most ECOWAS member states are vertically integrated. This will likely continue to be the situation for quite some time, because of the small sizes of these utilities and the prospects of economies of scale. The only aspect of unbundling expected in the short term is the unbundling of the utility's costs along the functional lines to allow for transparency and effective cost attribution necessary for efficient Cost of Service Studies and tariff determination in the electricity market. This cost unbundling is also mandated by the ECOWAS Directive C/DIR.1/06/13 on the Organization of the Regional Electricity Market.

The Regional Electricity Market Structure deals with issues around Phases of market development and market participants, generation technology and ownership, and financing structure.

Regarding market development phases, the ECOWAS REM was designed to develop in three phases. During the transitions from phase 1 up to phase 3, the market is designed to evolve in all the design characteristics – the Market Structure, the Market Architecture and Trading Arrangement, and the Market Rules. These stages in Market Development are included in the regional Market Design and reference is made to the different levels of competition in generation and wholesale trading, as well as to the expansion in the regional infrastructure development. The following figure summarizes the characteristic of each phase:

Table 5: Phases of the ECOWAS Regional Electricity market and characteristics

	Phase 1: Bilateral agreements	**Phase 2: bilateral agreements and DAM**	**Phase 3: Liquid competitive market**
Products and types of markets	Bilateral (cross border)	Bilateral contracts (cross border) and contracts which cross the Third country Spot market (day ahead market - DAM) Capacity market	Bilateral contracts (cross border) and contracts which cross the Third country Spot market (Px) Capacity market Ancillary service
Market participants	entities approved by countries, one entity per country, representing the country's power sector	Utilities and IPP	Any public or private entities that have a license

Special regulations to be adopted	Third-party access to the grid Regional transmission Tariff	DAM pricing Market monitoring and surveillance Market opening and third-party access	Ancillary service market regulations
Degree of competitiveness	Low competitive market	Competitive market on the spot market	Fully competitive market

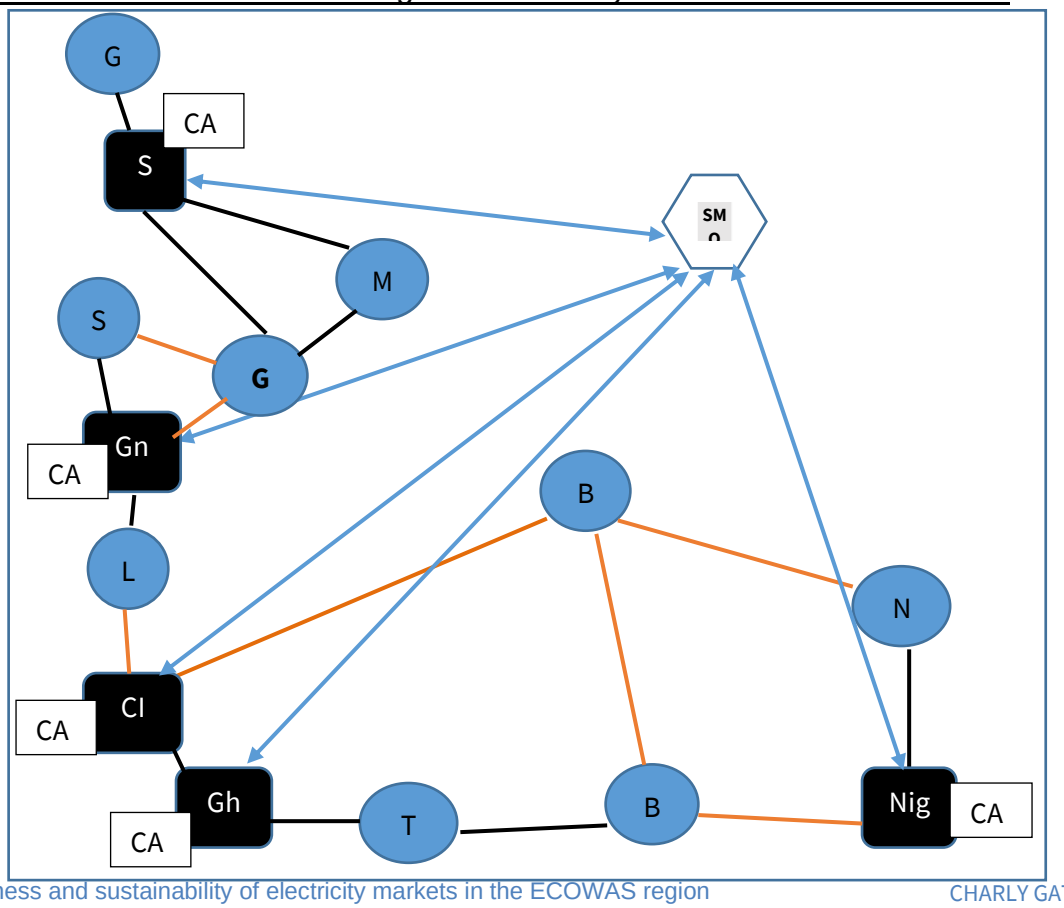
Key considerations for electricity Market structure are the technology used and ownership of the elements for power generation, transmission, and distribution. From the market design, electricity generation in the region will be contributed by thermal generators (i.e. gas, oil, diesel, coal and nuclear), hydro generators and renewable energy sources.

Regulation should make sure that none of the generators is big enough to constitute a threat to the health of the electricity market. Even with this regulation-guaranteed condition, the participants must be monitored regularly to ensure that there are no deviations from the norms.

In terms of the financing structure, apart from Nigeria, most of the power supply assets are owned by the governments, which are responsible for the provision of the investment capital. For the generation and distribution companies in Nigeria and a few IPPs in some other countries, the investment finance is provided by debt from commercial banks and by the equity contributions of the shareholders. The Debt/Equity (Gearing) Ratio is a regulatory decision to ensure a rate of return that is fair to both the operators and consumers. The market design envisages an increasing private sector investment and participation in the regional electricity market.

The structure of the regional electricity market can be represented by the figure below:

Figure 3: Phases of the ECOWAS Regional Electricity market and characteristics



Key

Nig = Nigeria, Nr = Niger, Bn = Benin Republic, Tog = Togo, Gh = Ghana, BF = Burkina Faso, Li = Liberia, CI= Cote d'Ivoire, Gn = Guinea, GB = Guinea Bissau, Ma = Mali, SL = Sierra Leone, Sn = Senegal, Ga = Gambia

Inter-Control Area Interconnection
Intra-Control Area Interconnection
Communication link between CAC and the SMO

Figure 3 above shows the fourteen national markets and systems in the ECOWAS region with their inter and intra – Control Area Interconnections, and the 2-way communication links between the Control Area Centres (CACs) and the SMO. Cape Verde which is the 15th ECOWAS country is excluded as it is an Island and not interconnected.

Regional electricity Market (REM) Architecture

According to Wilson, R. (2002), the market architecture consists of the map of component sub-markets in the electricity market, as well as the types of transactions and contracts driving the market. According to the design, the list of such sub-markets for the ECOWAS Regional Electricity Market, when the market is fully developed, includes:

a. Bi-lateral Market (Over the Counter Market): This is the type of contract that will mainly drive the REM and is responsible for about 85% of the total transactions in the wholesale electricity market. In this market, trade is carried out through Bilateral Contracts, which can be long-term, medium or short-term. The templates to be used for trading, have been approved by ERERA by resolution N°09/ERERA/17.
b. Spot or Balancing market (the market for immediate delivery), consisting of the Day-ahead, Intra-day and Real-time Market. The Spot Market will constitute about 15% of the total transactions in the REM.
c. Capacity Market: This market is to ensure that enough capacity is built and maintained to meet the future adequacy needs of the region. These markets are required to ensure that the resources needed for long-term reliability can recover the total cost of building and operating large generating facilities.
d. Ancillary services market: This consists of the market for reactive power services for voltage control, the market for reserve power services for frequency control, and the market for Black Start services for restarting the grid in case of total or partial grid failure.

Regulations for the competitiveness of the REM

The ECOWAS Electricity Market is currently being developed to enable the sustainable operation of an efficient, harmonized and coupled regional electricity market. The introduction of the Regional Electricity Market will result in enhanced cross-border trading, with the increasing challenge of detecting possible market misconduct. It is therefore

expected that Electricity Regulators, both national and regional, should strengthen their surveillance, supervision and cooperative efforts to ensure market competitiveness and that they stay ahead of the game. The development process of the Regional Market was initiated with a market design, which is characterized by a Market Structure (looking at the players in the market, in terms of numbers, sizes and the participants' financing structure), Market Architecture (which has to do with the sub-markets and trading arrangements), and Market Rules and Procedures (defining the relationships, as well as the rights and obligations of stakeholders in the market). Several Regulations, Rules and Market documents have also been developed for the operation of the regional electricity market. These rules and documents highlight operational functions consistent with power system reliability and efficient electricity market operation. Some of these market documents include:

- The Regional Electricity Market Rules, 2015
- Regional Transmission Pricing Methodology, 2015
- The WAPP Operation Manual, 2015
- The Regional Electricity Market Procedures, 2017
- Rules of Practice and Procedure of ERERA, December 2017
- Procedures for Application for Admission in the Regional Electricity Market, 2018
- Model Market Participation Agreement, 2018
- WAPP Transmission Service Access and Use Procedures (WTSAUP), 2019
- ECOWAS Regional Electricity Monitoring & Reporting Protocol, 2020

3. Coupling national markets to competitive regional electricity market: opportunities and proposed plan of action

Electricity markets differ in their designs in different countries and regions. There are two broad types of markets designed for West Africa. These are: a) the integrated market in which the System Operator centrally optimizes the scheduling and dispatch of resources, and b) an exchange-based market in which energy companies trade day-ahead and real-time at prices that clear the market. The integrated market is common in the ECOWAS Region and other developing regions.

This part deals with the characterization of the different national electricity in terms of the competition after the different waves of the reforms, and the chances of integration of these markets in the ECOWAS regional electricity market.

First, we characterize the two-level ECOWAS electricity market marked by the key roles of long-term contracts between the producer and the bulk supplier, The unbundling and opening level, the legacy of which determines the constraints on competition development more strongly than in the former industrial structures in the electricity industries.

Second, to characterise the potential for the development of competition, the main traits of each national electricity market are identified in terms of market attractiveness and market accessibility for the incumbents' competitors.

Third, dynamics of market development towards market integration are inferred at the ECOWAS level from these characteristics and the possibility for the development of new forms of power trade among foreign producers, suppliers and users.

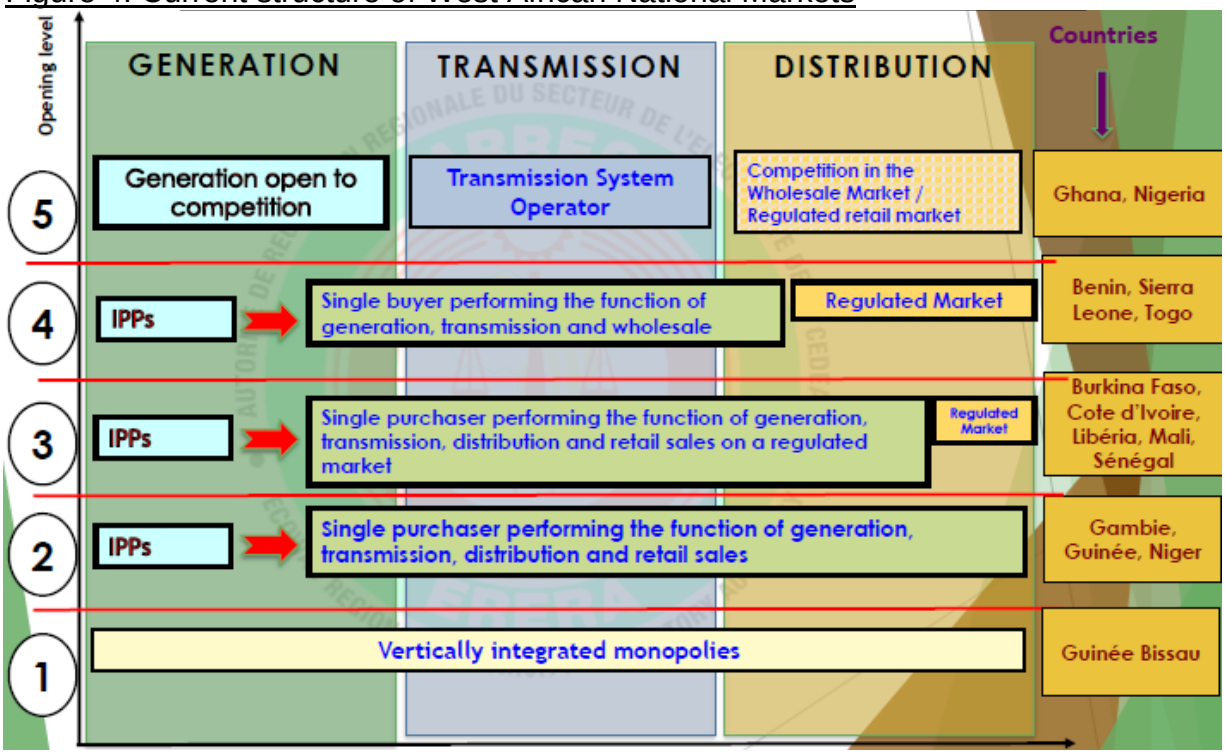
3.1. Two levels of the ECOWAS electricity market

The ECOWAS electricity market is represented on two separate levels:
- The national level, with the development of national or regional transport and wholesale monopolies. These monopolies developed the existing transport networks in coordination with the development of national production and later contributed to the setting up of the major power importation infrastructures with the producers. Industrial organization in distribution reflected the preexisting structure developed for city power distribution.
- The regional level, which is characterized by a two-sided oligopoly, is balanced between the major producers and the major national companies (Buyers).

The unbundling and opening level of national markets

The analyse of the national electricity market in the ECOWAS region shows the following common characteristics:
First, the Generation segment is open to independent producers. This is an achievement for all Member States. Except for Guinea Bissau, regulations in countries allow IPP to build and operate a power plant. However, issue of third-party access to the network and single buyers in most of the countries. In Ghana and Nigeria, the transmission is also open to competition and any IPP can sell to any transmission/distribution company.
Second, there is an abolition of the monopoly on the distribution and introduction of private operators in this segment in some countries. The following figure shows that except for Ghana and Nigeria which are fully open and all segment from generation to distribution are competitive; all national electricity sector is partially open for competition. Even if the distribution segment is open, the opening of the transmission segment is most critical in most countries.

Figure 4: Current structure of West African National Markets



Unbundling level

Third, regard to regulation performance, we can notice that twelve of the fourteen countries have established a regulatory body but in practice, there is a weakness or a lack of powers or independence in most of them. The 2020 AfDB Electricity Regulatory Index (ERI) shows that Niger is the first in the region with a score of 0.611 which interprets a substantial level of regulatory development. The second group of countries with a score between 0.500 and 0.599 concerns 6 countries which reflect an average level of regulatory development and the last group of 6 countries have a score between 0.000 to 0.499 representing a Low level of regulatory development. This result shows that the regulation performance in ECOWAS countries is low overall because it is in the second half of the ERI assessment scale. This invites national regulators but also governments to take more action to build regulations and regulatory authorities that are more efficient, solid, independent and endowed with the necessary powers to build competitive markets.

Table 6: 2020 Electricity Regulatory Index (ERI) of ECOWAS Member States

		2020
1	Niger	0.611
2	Nigeria	0.594
3	Senegal	0.561
4	Sierra Leone	0.561
5	Benin	0.550
6	Ghana	0.548
7	Togo	0.518
8	Cote d'Ivoire	0.497
9	Mali	0.441
10	Guinea	0.422
11	Burkina Faso	0.373
12	The Gambia	0.329
13	Liberia	0.285
14	Guinea Bissau	//

Source. AfdB (2021).

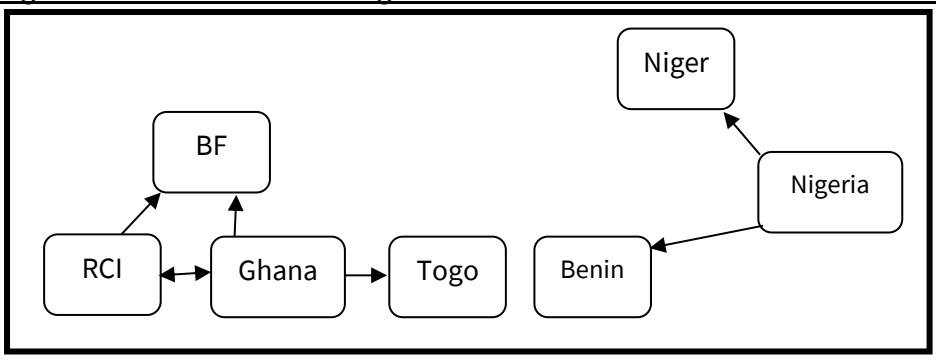
Regional market map

The regional market is characterised by a two-sided oligopoly, balanced between the major producers and the major national companies (Buyers).

The relations between national producers and purchasers take the form of long-term contracts (some are more than 25 years) that define a series of rights and obligations. Some of these contracts date back to 1972. On this institutional basis, the integrated ECOWAS market existed only in the bulk supply and is organised as an oligopolistic 'club'. The ECOWAS market can be described as a series of juxtaposed and entrenched national markets, supplied from outside by unidirectional stable flows coming from the same three sources of supply (Cote d'Ivoire, Ghana, Nigeria) directly to buyers without transit countries. Market integration on this basis of cross-border exchanges initiated by countries with a resource surplus relates only to sales from the three seller countries inside ECOWAS for now.

The regional electricity exchange is based on the different contracts already signed. The design of the REM provides that its contracts will always be valid and considered in the development phases of the market and particular phase 2 with the launch of the DAM market. The regional market can be represented in the current state according to the following figure. Exchanges take place bilaterally between suppliers and applicants and the role played by the OSM is limited to managing the capacities of transmission lines.

Figure 5: The REM exchanges are based on actual bilateral contracts



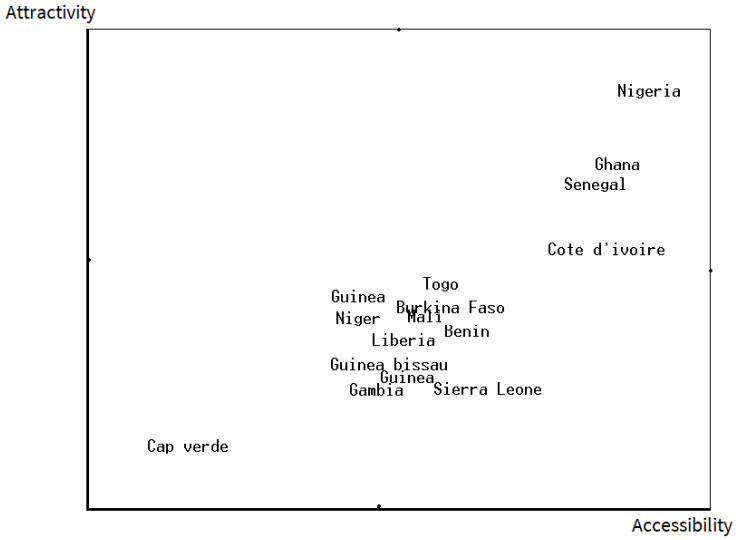
3.2. National market's attractivity and accessibility

This section characterizes the national electricity market in terms of market attractiveness and market accessibility for the incumbents' competitors. On one side, the market developments will depend on business potential in each national market, resulting at once from market size, market growth, (especially in non-mature markets and in some active market segments such as power generation), and price differences which reflect existing profits on several national markets. On the other side, the market developments interplay with the opportunities opened to applicants for entry by the accessibility of each market, or conversely by the possibilities offered to incumbents for preserving their dominant position and deterring entries. To describe and map the situation of each member country in terms of attractiveness and accessibility of the market, the competitive profile of the national market in each member country is analysed according to the grid described above.

In terms of attractiveness, three key elements are considered: size, growth and profitability. For each of the elements, the regulations make it possible to assess the situation of the country. The question that has arisen is whether the regulations put in place by the country are intended to increase attractiveness whether in terms of market size or market segments, whether on growth paths by segments or whether at the level of profitability assessed by regulation through competitive and attractive prices.

In terms of accessibility, four key elements are taken into account, namely accessibility at the technical, regulatory, commercial, industrial and capital market levels. As with attractiveness, the question that arose was whether the regulations put in place by each country are intended to increase market accessibility.

Figure 6: Map of attractivity and accessibility of Member States



Member States are mostly concentered on a centre and the higher level of accessibility on the quadrant. The most challenge for them is the attractivity of the market, especially for profitability and potential growth of the market. Nigeria, Ghana, Senegal and Cote Ivoire are at higher levels of attractiveness and accessibility. This level of attractiveness and appreciable accessibility of national markets is a prerequisite for competitiveness and an important step in coupling national markets towards a competitive regional market.

3.3. Integration of national markets to the regional electricity market

Since the launch of the ECOWAS regional electricity market in June 2018, there exists a dynamic interplay among regulatory, initiatives, business strategies and market structure. An ECOWAS convergence process seems to move towards creating the conditions for real contestability in electricity markets with ex-ante regulation of the access to networks and to promote the ex-post control by competition authorities at the national and regional levels.

Successive ERERA directives promoting strict unbundling (legally and functionally) between the competitive activities- power generation, power supply- and natural monopoly activities- the transmission and distribution networks are significant steps in this direction. This legislation suppresses different ways for the incumbents to exert market power (Helman, U. 2006).

Existing Institutional Framework

The existing framework for energy is fragmented and consists of the following:

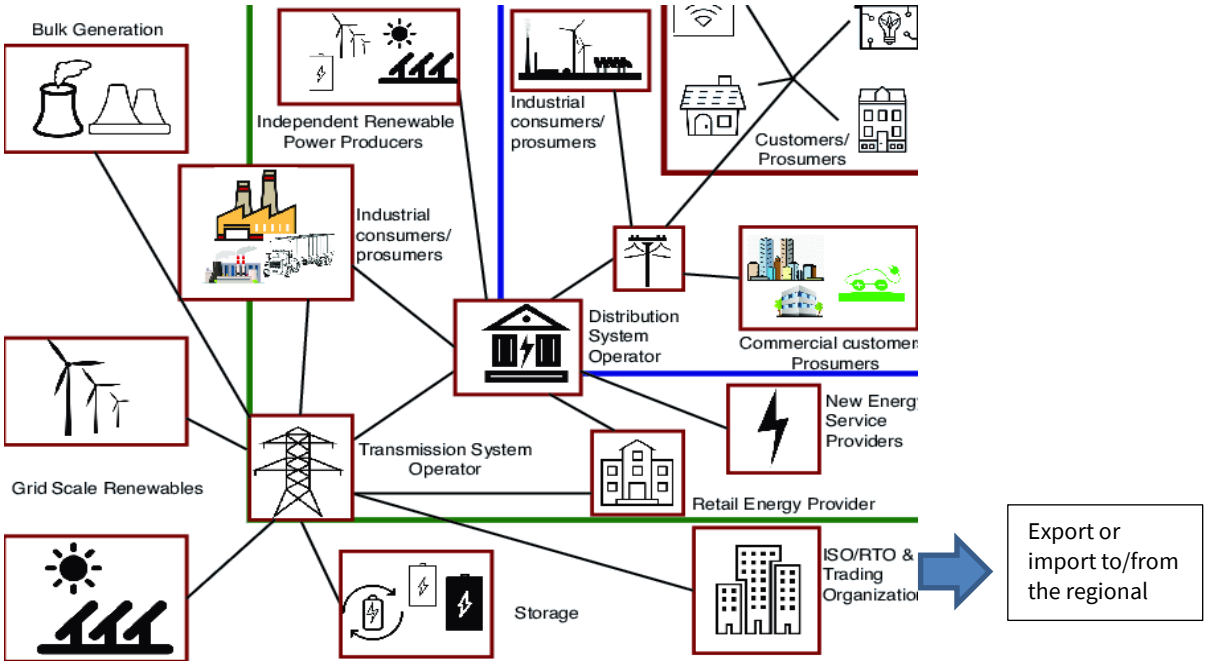
- Each national electricity market operates in isolation from national regulations aimed at increasing competitiveness at the national level.
- The regional market is currently limited to a few bilateral exchanges based on bilateral contracts signed several years ago and on sub-regional regulations of ERERA aimed at opening the market more to competition.

The configuration of current national markets is generally organized around many actors specifically involved at all levels of the sector's value chain. The various reforms and regulations to set up competitive markets have allowed the entry of new players and the construction of institutional arrangements that have made it possible to:

- The integration of renewable energy sources through IPPs using renewable sources such as solar PV or wind
- The development of customers/prosumers, commercial and industrials customers/prosumers
- The development of new energy services and aggregators

The figure below summarizes the configuration in national markets except that it must be recognized that not all countries are at the same level of the competitive market and therefore of institutional arrangements.

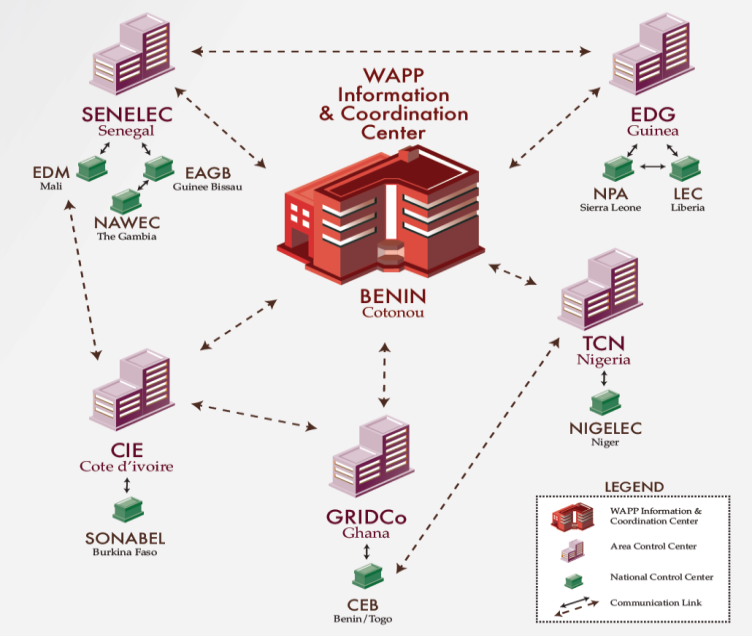
Figure 7: Configuration of ECOWAS national electricity markets



At the regional level, the configuration and institutional arrangements are as follows:

- The WAPP ICC and ERERA play key roles in the development and construction of a competitive regional market respectively in the management of system and market operations and the definition of regulations and market construction.
- In addition to its two players, the other market players are essentially the TSOs responsible for control areas and the TSOs operating in the market in the import/export of electricity exclusively through bilateral contacts.

Figure 8: Actual configuration of the regional electricity market



Proposed New Institutional Framework

The most important persisting shortcoming is the lack of integration between national markets. Key indicators in this respect are the absence of price convergence across the ECOWAS region and the low level of cross-border trade. This is generally due to the existence of barriers to entry, inadequate use of existing infrastructure and – in the case of electricity – insufficient interconnection between many member states, leading to congestion. Moreover, many national markets display a high degree of concentration in the industry, impeding the development of effective competition.

For more effective implementation and coordination of energy activities, especially involving private sector participation, it is necessary to have a streamlined, centralised and very coherent approach to policy implementation. These prerequisites would facilitate well-focused policy implementation, as well as represent incentives to investors wishing to invest in sub-sectors such as electricity generation.

The way the networks are regulated will fundamentally affect the network owners' investment policies and therefore impact the adequacy with which demand growth and shifts in the pattern of supply and demand are met. Depending on the choice of a model, the issue of the position of the transmission and distribution networks' monopoly becomes important. According to Nepal, R., Jamasb, T. (2012), The regulation of network tariffs, the provision of regulated or negotiated third-party access, and the degree of unbundling of the networks from competitive generation, trading, and retail activities strongly influence the overall effectiveness of competition in the market:

• The quality of access regulation and the level and structure of tariffs affect the competitiveness of the supply of power and the development of trade (Erdogdu, E. 2011)

• The degree of unbundling also plays an important role in this respect, as it keeps incumbent owners of networks from obstructing access for new entrants and avoids cross-subsidization of competitive activities by non-competitive activities

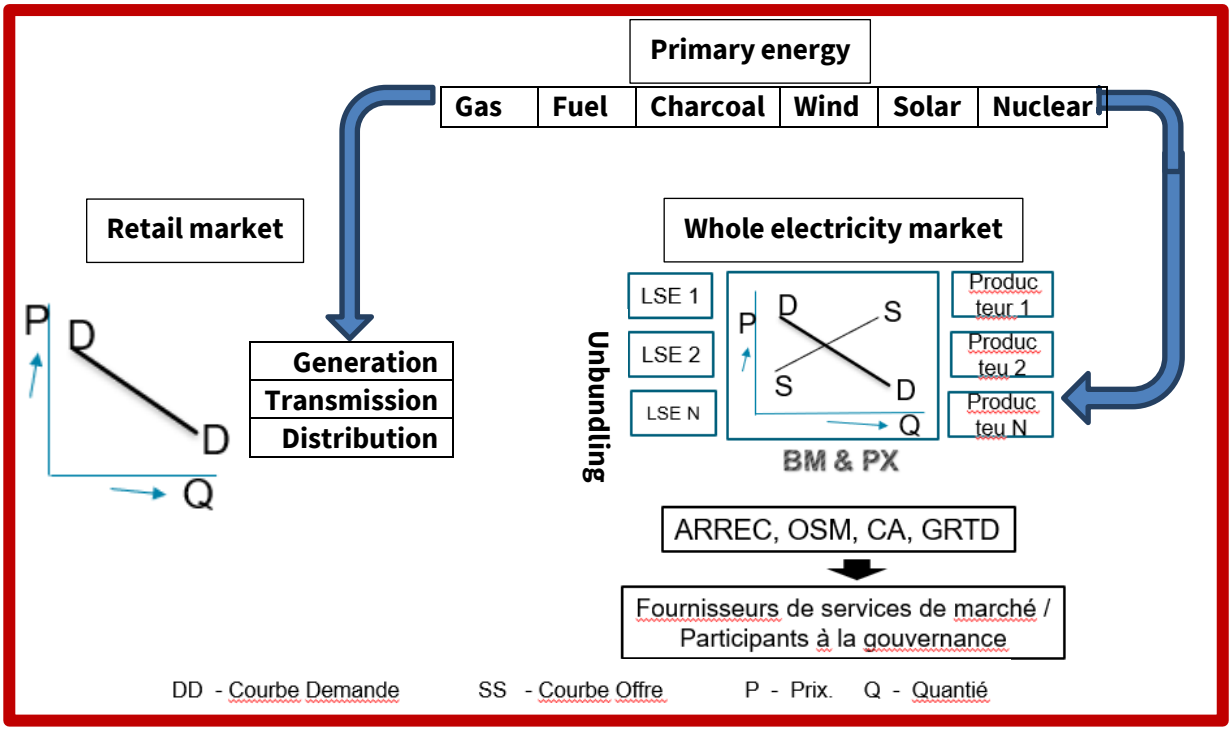
• Incentive regulation of transmission and distribution networks directly impacts the level of transport costs as a component of overall supply cost. In addition to access to transport, certain essential system operation functions need to be provided. The main functions are

scheduling and dispatch of transmission and distribution, balancing (in the case of decentralized markets), congestion management, and ancillary services (such as black-start capacity and voltage control). These functions can be designed in multiple ways, but because of their relation with network management they are often provided by the transmission network operator.

Also, the regional market will have to behave as an integrator of national markets. National markets remain the preferred markets in the region. They represent the retail market and the main markets for the provision of affordable and sustainable electricity to all ECOWAS citizens. The regional market complements as a major source of supply for countries with a deficit or resale of electricity for countries in surplus. The regional market will therefore have to consist of the various competitive national markets interconnected and integrated and in which any actor (generator as a distributor) can come to source or sell electricity. It is not a question of juxtaposing the different national markets but of creating a real regional market that is perfectly integrated with national markets and that competes with them through cooperation between national actors to meet the needs of citizens. In this context, the regional market is proving to be a tool for regional integration within ECOWAS.

The integrated structure of the ECOWAS regional electricity market can therefore be represented as follows:

Figure 9: Proposed integrated structure of the ECOWAS regional electricity market (REM)



This integrated configuration of the regional market is therefore marked by:

- National markets are divided into balancing markets and wholesale markets.
- Wholesale markets are subdivided into bilateral markets and electricity exchanges (PX).
  - Electricity Exchange: Day-ahead and real-time markets
- The regional market is composed of the national markets and the Interconnection Capacity market.
- There must be reasonable harmony between national markets for the Interconnector Capacity Market to function effectively.

- In the electricity market designed for the ECOWAS region, electricity can be exchanged either bilaterally or through the exchange.
- In most cases, the exchange market complements the bilateral market.
- Bilateral contracts are negotiated between two parties, one buyer and the other seller, as is the case for the old cross-border contracts that are still ongoing and have been concluded for several years.
- On the PX, traders can quote their bids and bid one day before physical delivery.
- The exchange operator aggregates supply and demand separately and frees the market based on the balance between supply and demand.
- It is envisaged for the REM that the PX (spot) markets represent about 15% of the size of the wholesale market, the bilateral contract market will always be large (about 85%) since market participants will still need transactions with prices and quantities covered
- Electricity regulators, both in national and regional markets, need to strengthen their supervision, control and cooperative efforts to avoid power market situations.
- It is therefore necessary that, from the outset of the market, market surveillance rules and procedures are put in place to limit bad behaviour.
- All market activities require rules, codes and procedures (i.e. procurement documents) to ensure market transparency, integrity and efficiency.
- Procurement documents shall specify market functions and indicators to facilitate market monitoring, evaluation and control.

3.4. Recommendations and plan of action

Strengthening the competitiveness and sustainability of national and regional electricity markets is a step-by-step process in which Member State governments, national regulators as well as the regional regulator, the SMO and TSOs/DSOs each play a role. Based on our analysis, we make the following recommendations to enhance market competitiveness and regional integration:

On Policies and Energy sector Governance

The development and management of the energy sector have long suffered from a lack of appropriate policy, institutional, legal, and regulatory framework. Therefore, there is a need to institute a new governance structure for the energy sector that would meet the challenge of developing a coherent and clear framework of energy governance, which addresses in an integrated manner, the key issues that will guide the effective implementation of the energy policy and implementation of a competitive market.
To this end, the Government shall:

- Review existing institutional arrangements to improve coordination of actions of the various institutions and ensure the efficient management of the energy sector.
- Institute mechanisms to facilitate the effective implementation of the energy policy and in so doing achieve the economic, social, and political goals
- Create incentives to attract private sector investment including, wherever relevant and appropriate, access to loans on concessionary terms; financial instruments, government guarantees and “smart subsidies” (or grants) for infrastructure investment.
- In some countries, establishing a regulatory agency provides even-handed and predictable energy sector regulation

On market operation and Strategies

Utilities (TSO and DSO) shall:

1. Implement the power sector reform strategy defined by the competent authorities
2. Develop a competitive power supply sector with the participation of local communities and the private sector.
3. Improve the efficiency of the existing distribution system and expand the system at a minimum cost
4. Rationalize electricity tariffs to reflect the marginal cost of supply to achieve economic efficiency.
5. Institute measures aimed at improving the efficiency of the supply side including the reduction of technical and commercial losses
6. Develop a national grid that will extend the transmission line throughout the country.
7. Actively participate in regional and sub-regional programmes that are aimed at the supply of electricity.
8. Implement functional unbundling and/or accounting separation of functional activities

On Regulation and Policy statements

The regulator is the key actor who is responsible for the development of a competitive and sustainable market which can attract investors and allow the sector's financial viability (sustainability). For that, regulators shall:

1. ***Establish and guarantee the independence and power of the regulatory body.*** The following actions can be done:
   a. remove the provisions that allow the executive to overturn the regulatory decisions of the regulator.
   b. make provision for a longer and fixed non-renewable term of office for commissioners/Board[1].
2. ***Strengthen the Accountability of the Regulator*** with the following actions:
   a. submission of an annual report for review, preferably to the legislature
   b. The primary legislation of regulators should be amended, or appropriate secondary legislation enacted or
   c. Establish dedicated energy tribunals or specialist appeal institutions to speed up the appeal process
3. ***Enhancing Financial independence*** through these actions:
   a. Regulator Funding should be done preferably from fees and levies at levels approved by the legislature.
   b. Budgets of regulatory authorities should not require annual approvals or validation from the government.
   c. Post-expenditure audits should be carried out at the end of the financial year to ensure good management of funds by the regulatory authority.

[1] This will also do away with the existing situation in most countries, where commissioners' terms of office run in tandem with the government that appointed them. This minimizes the influence of the government over the entire composition of the board at any point in time.

d. Salaries of commissioners should be competitive and regulatory authority staff salaries set by the board of the regulatory authority at the same level or higher than those of operators.

4. ***Improving open access to information (amount and consistency) and transparency tools.*** This can be by:
   a. Periodic utility performance update as measured against regulatory benchmarks
   b. Set up information and transparency platforms to increase transparency in the market. This issue of transparency is deeply connected with efficiency and competitiveness
   c. Develop and implement tools and systems for transparency and market surveillance

5. ***Establish and guarantee an attractive and competitive tariff.*** Actions can be:
   a. Initiate if not exist, a Cost of Service (CoS) tariff study which should at a minimum recommend cost-recovery tariffs for the generation, transmission, and the distribution segments

6. ***Improve the quality of Service regulations*** through the following actions:
   a. Develop comprehensive QoS regulations, covering all aspects of reliability indices, including SAIFI, SAIDI, and CAIDI. This should also include implementable incentives and penalties.
   b. Develop a performance monitoring framework of utility performance identification of Key Performance Indicators (KPI)
   c. Compel utilities to publish their performance and produce a regular report (annually, semiannually, etc.)

7. ***Promote entry of multiple players in the power generation including private and public investors as Independent Power Producers.*** Actions can be:
   a. Supervise the development of model power purchase agreements for different types[2] of generation technologies.
   b. Develop and publish procedures for approving or giving no objection to PPAs signed between utilities and power generators (IPP) with price adjustment mechanism
   c. Ensuring non-discriminatory access to networks or third-party access to the network

To increase the competitiveness of national and regional electricity markets, it is important to increase the contestability of markets. To do this, the following actions can be implemented:

1. **Remove legal barriers to entry.** At the national level, all barriers to entry should be removed. However, with regards to the specificity of the sector, the delivery of a national license to stakeholders to enter the market should not be removed but simplified and limited to an asset if the stakeholder has all technical and financier prerequisites to trade in the market. At the regional level, the regulator should make sure that any actor can trade in the REM without being a member of WAPP but should have at least a national license.

[2] The type of power purchase agreements signed between distribution utilities and generation companies with price adjustment clauses are key factors for the sustainability of the utilities and the sector

2. **Force firms to allow competitors to use its network** Any actor who wants to trade in the national or regional market must be forced to use the national transmission grid and national-specific lines dedicated to regional transmission service.
3. **Legislation against Predatory Pricing** If a firm can engage in predatory pricing it can force new firms out of business and make it less contestable.
4. **Regulators can legislate against the abuse of Monopoly power.** If a firm abuses its monopoly power by restricting supply to certain firms the national or regional regulator, can intervene to overcome this restriction on contestability.

It is important to remember that contestability is not a clear-cut issue, there are degrees of contestability, and some markets have more capacity for new firms to enter. In practice, few industries are perfectly contestable.
The proposal framework market aims the coupling the different national markets to the regional electricity market, ensuring optimal use of cross-border transmission capacity while utilizing a set of proposals and network codes to achieve its goals. However, successful integration requires that electricity markets across the ECOWAS region share a set of common features and are linked by the efficient organization of interconnection capacities. To this end, several issues still need to be addressed to effectively improve the electricity market" design and functioning.

The implementation of this proposal in the ECOWAS regional electricity sector will:

- Increase competition and reduce the potential for market concentration and market power issues, decreasing prices
- Create an equal level playing field between Market Participants providing cross-border trade opportunities and the possibility to reduce barriers to entry into markets through a clearer and more stable framework
- Optimally use existing transmission capacity and signal the investments to build new capacity
- Enhance the integration of renewable energy by providing liquid Intra-Day Markets in which positions can be adjusted
- Limit risk for all market players by providing opportunities to hedge risk in different timeframes

Conclusion

This paper aims to analyze the process of deregulation of national markets and the construction of competitive markets within the ECOWAS region.
In a perfectly transparent wholesale electricity market, the most intuitive way of analyzing its competitiveness would be to look at the changes in market participants' bidding curves over time. A systematic deviation of bids from marginal costs, especially in peak-demand hours when prices are high, would be an indicator of abuse of market power and a lack of competitiveness. However, due to the lack of such in-depth data for the national and regional electricity market in the ECOWAS region, this paper use method which does not necessarily rely on firm-level data. We described and analyzed the evolution of reforms and market configurations, then we identified the progress and challenges, the key factors and the conditions for coupling national markets to the regional market.

The analysis of the evolution of reforms for liberalization and competitiveness of electricity markets at ECOWAS Member States shows 3 periods: the first period ('90s) is marked

by the liberalization of the sector under the injunction of the Breton Wood institutions (WB and IMF), the period of proactive implementation of liberalization policies in the early 2000s which gave some progress in the liberalization of the sector in many countries and in particular Ghana and Nigeria and finally a recent period of the renewal of the reforms which coincide before the will and the political actions at the regional level for the development of the regional market of electricity which involved the installation of many reforms in Member States.

We used several factors of competitiveness to compare the competitiveness and the status of development or state of restructuring of national markets in the ECOWAS region.

The construction of the regional electricity market is currently in phase 1 of the 3 phases planned and concerns exclusively exchanges between neighboring countries based on bilateral contacts often concluded for decades. WAPP and ERERA each work to define and implement regulatory, legal, policy and operational frameworks for the construction of a competitive regional market. If the current situation appears to be the juxtaposition of national markets and the very poorly integrated and interconnected regional market, the current challenge is the coupling of national markets to the regional market.

The proposal framework market aims at coupling the different national markets to the regional electricity market, ensuring optimal use of cross-border transmission capacity while utilizing a set of proposals and network codes to achieve its goals. However, successful integration requires that electricity markets across ECOWAS Region share a set of common features and are linked by an efficient organization of interconnection capacities. To this end, several issues still need to be addressed to effectively improve the electricity market" design and functioning.

Organization and operations of the regional power market are based on free access to the regional transmission system and access for eligible clients, in other words, market access conditions, interconnection, and use of the regional transmission network.
The establishment and the future of the regional electricity market in West Africa shall be based on good organization and good functioning of the national markets of each of the fourteen states of the WAPP. In this regard, some countries are key nodes by their position and level of development, which makes them today and tomorrow, major players in the development of the regional market.

The recommendations to increase competitiveness in the markets are formulated for governments who must put in place the policy framework and institutional arrangements that can lead to more competition in the sector and attract investment; national regulators as well as the regional regulator who must put in place regulations facilitating third party access to the grid, competition within each market segment, limiting market power and ensuring a remunerative tariff; and finally, recommendations concerning the strategy of the actors and in particular the TSO and DSO who will have to implement the functional unbundling and guarantee the competitive power supply and the efficiency of the distribution system.

References

AfdB (2021). Electricity Regulatory Index for Africa 2020, Abidjan, 108p

Armstrong, M., Cowan, S. and Vickers, J. (1994). Regulatory Reform: Economic Analysis and British Experience. The MIT Press, Cambridge (Mas.).

Baumol, W., Panzar, J. and Willig, R. (1982). Contestable Market and the Theory of Industry Structure. Harcourt, New York.

Bergman, L., Neven, D.J., Gual, J., et al. (1998). Monitoring European Deregulation: vol.1: Europe's Network Industries: Conflicting Priorities (Telecommunications), London: Centre for Economic Policy Research.

Borenstein S., Bushnell J., and Stoff S., (2000). The competitive effects of transmission capacity in a deregulated electricity industry, Journal of Economics, 31 (2), 294-325

Borenstein, S., Bushnell, J. B., Wolak, F. A., (2002). Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market. The American Economic Review 92 (5), 1376–1405.

Bushnell, J. B., Mansur, E. T., Saravia, C., (2008). Vertical Arrangements, Market Structure, and Competition: An Analysis of Restructured US Electricity Markets. The American Economic Review 98 (1), 237–266.

Crampes and Laffont, (2001). Transport pricing in the electricity industry. Oxford review of economic Policy, 17 (3), 313-328

Eberhard, A., and K. Gratwick. (2008). "Demise of the Standard Model of Power Sector Reform and the Emergence of Hybrid Power Markets." *Energy Policy* 36 (10): 3948–60.

Eberhard, Anton and Catrina Godinho, (2017). A Review and Exploration of the Status, Context and Political Economy of Power Sector Reforms in Sub-Saharan Africa, South Asia and Latin America, *Management of Infrastructure Investment and Reforms in Africa* (MIRA) Program Working Paper, University of Cape Town Graduate School of Business

Erdogdu, E. (2011). The impact of power market reforms on electricity price-cost margins and cross subsidy levels: A cross country panel data analysis // Energy Policy (39), 2011. pp.1080-1092.

European Commission EC-DG TREN. (2003). Second Benchmarking Report on the Implementation of the Internal Electricity and Gas Market. European Commission, Brussels

Fabra, N., von der Fehr, N., and Harbord, D. (2004). Designing electricity auctions. Center for the Study of Energy Markets, University of California, Berkeley, CSEM WP-122, February.

Glachant, J., & Finon, D. (2000). Why do the European Union's electricity industries continue to differ? A new institutional analysis. Chapters, in: Claude Ménard (ed.), Institutions, Contracts and Organizations, chapter 21, Edward Elgar Publishing.

Glachant, J.M. and Finon, D. Eds. (2003). Competition in European Electricity Markets: A Cross-Country Comparison. Edward Elgar, Cheltenham.

Helman, U. (2006). Market power monitoring and mitigation in the US wholesale power markets. Energy, 31(6–7), 877–904.

Joskow, Paul L. and Edward Kahn. (2002). A Quantitative Analysis Of Pricing Behavior In California's Wholesale Electricity Market During Summer 2000, Energy Journal, 2002, v23(4), 1-36

Laffont and Tirole (1996). Creating competition through interconnection: theory and practice, Journal of regulatory economics, 10 (3), 227-256

Mansur, E. T., (2008). Measuring Welfare in Restructured Electricity Markets. The Review of Economics and Statistics 90 (2), 369–386

Mohr J. (2018), The Foundation of Energy Regulation in Europe on the basis of art. 102 TFEU- The example of energy grids, In: A. Metaxas/ L. Hancher (ed.) (2018), *The transformation of the EU and Eastern Mediterranean Energy Networks, Legal, Regulatory and Geopolitical Challenges*, European Energy Studies, Claeys & Casteels, Belgium, pp. 13-21.

Nepal, R., Jamasb, T. (2012). Restructuring the power sector in transition: Do institutions matter? Energy Economics (34), 2012. pp. 1675- 1682

Newbery, D. (2001). Issues and Options for Restructuring the Electricity Supply Industries. Cambridge University, Working Paper, Department of Applied Economics.
Puller, S. L., (2007). Pricing and Firm Conduct in California's Deregulated Electricity Market. The Review of Economics and Statistics 89 (1), 75–87.

Wilkens, S., Wimschulte, J., (2007). The pricing of electricity futures: Evidence from the European energy exchange. Journal of Futures Markets 27 (4), 387–410.

Wilson, R. (2002). Architecture of power markets. Econometrica, 70(4), 1299–340.