Definition and Revision of the Detailed Rules and Procedures for Market Surveillance (Activity 2)

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1. List of Acronyms and Abbreviations

ACE	Area Control Error
ADR	Alternative Dispute Resolution
AGC	Automatic Generator Control
ATC	Available Transfer Capacity
BA	Bi-Lateral Market
CAC	Control Area Centre
CEH	Continuing Education Hours
DA	Day-Ahead market
DTSO	Domestic Transmission System Operator
ECOWAS	Economic Community of West African States
ERERA	ECOWAS Regional Electricity Regulatory Authority
LPC	Large Power Consumers
MCP	Market Clearing Price
MCV	Market Clearing Volume
MPA	Market Participation Agreement
MW	Mega-Watt
MWh	Mega-Watt hour
NCC	National Control Centre
NRA	National Regulatory Agency
NSP	Network Supply Point
OM	Operation Manual
PX	Power Exchange
REM	Regional Electricity Market
RMP	Regional Market Procedures
RMR	Regional Market Rules
RTG	Regional Transmission Group
SMO	System Market Operator

TTMW	Transmission Tariff Methodology for WAPP
WAEMIS	West African Electricity Market Information System
WAPP	West Africa Power Pool
WAPP OM	WAPP Operation Manual
WAPPITS	West Africa Power Pool Interconnected Transmission System
WTSAUP	WAPP Transmission Service Access and Use Procedures

2. Executive Summary

Background

The ECOWAS Electricity Market was launched in June 2017 and is currently being developed to enable the sustainable operation of an efficient, harmonized and coupled regional electricity market. The Market which was designed to evolve in three phases is currently in phase 1 where cross-border transactions are wholly through bi-lateral contractual arrangements between member states of adjoining countries. Phase 2 of the Regional Electricity Market will result in enhanced cross-border trading, allowing for the introduction of a day ahead market to co-exist with the bi-lateral transactions as well as the admission of eligible customers as market participants.

The increasing complexity of the market arrangements will no doubt create more challenges with regards to compliance of market participants with the Market Rules and other Market Documents and creates the need for better tools and procedures for the detection of possible market misconducts. It is therefore expected that ERERA, as regional electricity regulator, working together with the national regulatory authorities, should strengthen their surveillance, supervision and co-operative efforts to ensure they are fully prepared to deal with the challenges of effectively monitoring the complexities of the regional electricity market.

A number of Regulations, Rules and Market documents have since been approved by ERERA for the effective start and efficient operation of the regional electricity market. These rules and documents highlight operational functions consistent with power system reliability and electricity market operation, necessary for running a viable regional electricity market. 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, 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

Article 16 of the ERERA Regulation gives ERERA the requisite powers to monitor the operations of the regional electricity market to prevent market abuse and distortions and gives it the powers to sanction defaulters. Specifically, the article provides that ERERA shall “prevent and/or sanction defaulters of anti-competitive practices, abuse of dominant position and all other violations of market operations

rules or licenses or authorizations and when necessary, initiate process to enforce compliance in case on non-execution of sanctions".[1]

The purpose of this Report is to assist ERERA in developing and adopting effective Rules and Procedures for Market Surveillance, to support an efficient and reliable regional electricity market, based on international and regional best practices, subject to the Regional Market Rules (RMR). The Report deals with the basic elements of Market Surveillance, the comparative review of the ECOWAS Market Design, the roles of ERERA, the SMO and other stakeholders in monitoring market participants' behavior in compliance with the Market Documents, Reporting Obligations of all stakeholders as well as Enforcement and Sanctions in Market Surveillance.

Elements of Market Surveillance

Market Surveillance entails monitoring of compliance by all Market Participants, including the Market Service Providers, with the market policies, regulations and procedures as provided in the Market Documents. The market monitoring concept is used for policing and securing the integrity of the electricity market. The responsibilities of the Market Monitoring Entity (or the Market Surveillance Authority) is to observe the market, identify problems and suggest improvements or implement sanctions. Market Surveillance includes the evaluation of submitted market data. A high degree of transparency of the Wholesale Electricity Market reduces the risks of market distortion and interference with price signals and ensures that end consumers pay a fair price for electricity supplied.

The main Market Surveillance activities include:

- detection of attempts to exercise market power, manipulate the market or engage in other fraudulent behaviour;
- monitoring of market performance to enable control of market development;
- identification of market design imperfections;
- monitoring of the behaviours of the market participants (activities and transactions);
- controlling of transmission network and generation plant outages;
- investigations of possible violations of the Regulations, Rules and Procedures of the electricity market;
- enforcement of compliance, with the primary goal to achieve compliance and not necessarily to impose penalties.

Market Surveillance involves monitoring of both the behaviour of Market Participants and the Regional Market Institutions, to ensure compliance with the technical and commercial provisions of the Market Documents. It also involves the regular evaluation and assessment of the Market Documents for adequacy and efficiency of the Regional Electricity Market, as well as the market design to detect any flaws that may result in significant inefficiency or market failure. The Market Documents may be reviewed as necessary to ensure sustained relevance and adequacy.

Market Surveillance, in particular, plays a significant role in anticipating the potential vulnerabilities to the Electricity Market. It is a pre-emptive measure aimed at detecting and deterring potential

[1] Regulation C/REG.27/12/07 on the Composition, Organisation, Functions & Operations of ERERA

market abuse, including market manipulations, insider trading and market power (which is the ability to control prices, either alone or in a collusive arrangement, like a cartel).

Market Design

This Report deals with the review of the design of the ECOWAS Regional Electricity Market, as well as a comparative review of the design of the Electricity Market in some developed Regions, highlighting the key lessons, challenges to the design of ECOWAS Regional Electricity Market and recommendations for the enhancement of the ECOWAS REM design. It also presents the key Functions for the Regional Electricity Market, as provided in the Market Documents and highlights the indicators to monitor the implementation of the Functions.

This Report also forms the basis for the draft Rules and Procedures for Market Surveillance which is presented as a separate deliverable. The Rules and Procedures highlight the prohibited activities, roles of the various stakeholders, reporting obligations, data management as well as enforcement procedures and sanctions.

A key component of Market Surveillance is the investigation of the Market Design to ensure that there are no flaws, which Participants can capitalize on and take advantage of, to manipulate and game the Market. 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).

Good market design begins with a thorough understanding of the Market Participants, their incentives and economic problems that the market intends to solve. The Market design should be informed by the past successes and failures of actual markets around the world. Ideally, the design will include all the key ingredients of success and avoid the flaws that have led to market failures, as observed from the reviews.

In many respects, the design of the ECOWAS Regional Electricity Market is consistent, in the objectives and principles, with the best practice standards in electricity market designs. There are differences in market structure, trading arrangement and market rules, but these are mainly as a result of the differences in levels of development and sophistication of the regional markets. As the ECOWAS electricity network expands and the market develops, the design will be reviewed and most of these differences will be eliminated.

However, in order to keep abreast with the evolving trends in global electricity sector development, the Report made some recommendations on the further improvement of the current REM design. The Market Design for the region should take into consideration the variability of electricity consumption and the intermittent production from the renewable energy sources (RES). This is in consideration of the growing importance and increasing contribution of RES in the global generation mix. The market should be flexible enough to face the challenges of increasing levels of RES.

Like in other regional markets, the goals of the ECOWAS Regional Market should be framed within long-term views and reviewed from time to time, in the light of changes and actual experiences arising

from the current reality of the regional power market on its way to maturity. This is in line with the principle of gradualism, which the ECOWAS Regional Electricity Market is based on.

There is also the need to consider the increasing interest in the national electricity market where consumers are also producers of electricity (ie Prosumers), in the design of REM and provide for this in the Market Design.

Assessment of Operational Functions of the Regional Electricity Market (REM)

The Operational Functions of the REM are those critical activities that have direct impacts on the reliability of the WAPP Interconnected Power System, as well as on the development and efficient functioning of the Regional Electricity Market. These Functions are also highlighted in the primary and secondary regulations for the preparation and definition of the electricity market. Fundamentally, the Functions are groups of tasks required for maintaining power system reliability and efficient operation of the electricity market, and therefore must be defined before the start-up of the electricity market. The Associated Indicators to these group of Functions are the procedures for performing the Functions. Thus, the availability of the procedures is an indication that the Function will be implemented. These types of indicators (ie availability of the procedures) are monitored mainly by observation, and are concerned with the macro issues of Market Surveillance.

Operational Functions of the electricity market can be divided into two categories, namely the Technical (or Physical) and the Commercial (or Merchant) Functions. The Technical Functions of the electricity market are embedded in: Generation, Transmission, System Operations, and Distribution functions, and are mainly responsible for the reliability and technical stability of the Regional Power System. These functions include the operating and planning – related functions.

The Commercial functions are embedded in wholesale market operations (consisting of the bilateral, day-ahead, real-time, and ancillary services markets), and the retail market operations. These functions are responsible for the development, commercial stability and efficient functioning of the Regional Electricity Market. It should be noted that these Functions are defined in the regulations (primary and secondary), which must be in place before commencement of the market as part of the conditions precedent.

The Report describe the Operational Functions identified in the Regional Market Documents. The Report also show the relationships between the Market Functions and the associated Indicators, as well as the Benchmarks, upon which the Regional Electricity Market Surveillance are based. Altogether, a total of twenty-three (23) Technical Functions and thirty-one (31) Commercial Functions were identified. These are contained in Annex 1 of the Report. These Functional Indicators will form the basis for the Regional Electricity Market Surveillance at the macro level.

Data Management

As against the indicators for the preparatory phase of the market, there are indicators for the implementation or operational phase of the market. These indicators are in the form of Market data (eg numbers, values or levels of something compared with something else) for the evaluation of the performance of Market Participants or the Electricity Market, for the granular aspects or micro issues of Market Surveillance, monitored through data gathering, validation and analysis.

The collection and Analysis of Data is a critical tool in market monitoring as the detection of Market abuse is often based on the analysis of data submitted by market participants or collated by the market monitor. Data collection refers to the process of acquiring and gathering a number of data sets. There is no universally accepted set of Market Monitoring Statistics and indices. In practice, there is a large set of data and indices that are monitored on varying time scales. Such data consists of both public domain information (e.g. wholesale market outcomes, network measurements, etc.) and confidential information (such as market participants' asset information and bids and offer prices). The following groupings serve as a useful guide for data collection management, for market monitoring:

- Market Price,
- Demand & System Conditions;
- Market Structure Indices;
- Supplier Indices;
- Market Performance Indices.

The Report provides guidance on the various aspects of data management including data collection, data verification & validation; data analysis and data protection. The Report also provides detailed information of the collection, analysis and use of data for market monitoring while also stating the importance of protecting commercially sensitive data and making it obligatory on the part of the SMO and ERERA to ensure that confidential data are duly protected and kept confidential.

Coordination framework for key stakeholders involved in the regional electricity market surveillance

Effective surveillance of the regional market will require the active collaboration of regional and national entities considering the fact that the regional market participants are all licensed within the ambit of national laws. The Regional Market is the outcome of establishing a higher hierarchical level of organization of several national markets, so that their interactions become stronger and subject to well-defined commonly agreed rules.

The interactions among market participants and market service providers from different countries and any subsequent breach of commercial and technical rules arising from such interactions will have cross-border consequences affecting at least two or more countries. This therefore means that national and regional institutions involved in regulation, transmission systems operations and market operations must collaborate on an ongoing basis to ensure the efficient operation of the regional market and curb any attempts at market manipulation and technical lapses that may jeopardize the effective functioning of the market.

Electricity Regulators, therefore, both national and regional, should strengthen their surveillance, supervision and co-operative efforts to deal with such issues whenever they are observed. Also, the Regional System and Market Operator (SMO) will have a number of interface areas with the Domestic TSOs and the Control Areas to address surveillance issues at the Regional Market. Also, such interface areas will need to be strengthened.

The report provides the obligations of all entities involved in market surveillance in critical areas such as Information gathering, Reporting, Investigation, Sanctions and Enforcement.

Enforcement in Market Surveillance

Market Monitoring, in most cases is an ex-post exercise. NRAs address market abuses that may impact on the regional market through after the fact investigation. Where there are suspected cases of violation or breaches, these are referred to the SMO and ERERA for investigation and enforcement. The general compliance and enforcement tools include compliance audits, investigations, spot checks, and other procedures for identification of breaches and assessment of penalties for noncompliance. Sanctions and Penalties are important tools in Market Surveillance as they act as a deterrence against market abuses and non-compliance.

The report highlights the categorization of types of breaches, procedures for investigation by both the SMO and ERERA, enforcements including imposition of sanctions and penalties as well as the right of appeal for Market Participants not satisfied by the decisions of the SMO or ERERA.

3. Introduction

3.1. Project Background

Electricity has been historically provided by vertically integrated geographic monopolies, where all the 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, introduction of competition in the generation and supply segments and introduction of open third party access to the transmission and distribution networks, in order to better meet the rapidly growing power demand, improve supply reliability, achieve better economic efficiency and reduce total system losses and costs.

The demand for affordable, reliable, secure and low carbon electricity is on the rise globally. This growing demand is driven by the desire to reduce the health and environmental impacts of electricity services (from the conventional generators) and expand energy access to underserved and unserved customers. Consequently, low carbon variable renewable energy resources have been introduced in the generation mix and are increasing their shares of electricity generation globally. However, expanding the penetration of these resources with variable and unpredictable outputs has increased the problem of imbalances, and therefore require power systems that can adjust quickly to balance supply and demand.

The overarching goal of the electricity market is the provision of reliable electricity at prices that are affordable by the consumers. Over the years electricity markets have evolved to address complex economic and technical challenges to achieve this goal. Every second, the supply of and demand for electricity must be in balance. If this balance must be achieved, huge resources will need to be expended and network constraints must be overcome. Also, the market must send the right price signals to motivate efficient investments in generation and consumer behaviour. Globally, the electricity market is undergoing massive restructuring to enable the achievement of the above conditions, and the restructured market illustrates the importance and power of effective market design.

Every electricity market goes through a design process, and good designs have always been very important. Design mistakes can cause major market failures, as illustrated by the California electricity crises of 2000-1. Fortunately, because of good governance and technological progress, market designs have improved over time. Flaws have been identified and largely addressed. However, electricity market design is still far from static. New challenges are emerging with the on-going transformation of the electricity industry. Some of the forces driving change include the expansion of renewables, distributed generation, etc. The main renewable resources (solar and wind) are intermittent, and the market design must be able to handle this. Today's national and regional markets can handle a moderate share of renewable generation, but a major shift in generation mix due to renewable energy resources will require an adjustment in the market design.

Each element of the electricity market design is linked to a facet of reliability needs of the power system, along with measures that allow for economically efficient operation and competition in the electricity market, while limiting the possibility of market power. The rules that govern the operation of these markets are always evolving as new technologies enter the market.

The key objectives of the electricity market design are consistent with the goal of the electricity markets, i.e. the provision of reliable electricity at the least cost to the consumers. These key objectives are:

- **Short-term market efficiency**: ensuring reliability of the power system. Reliability requires a reserve to satisfy demand when demand and supply uncertainty would otherwise lead to a shortage.
- **Long-term market efficiency**: ensuring that the market provides the proper incentives for long-term investments for power system adequacy and security. This remains the most challenging and important aspect of the market design objectives. The drive to restructure electricity markets emerged from poor investment decisions under the rate-of-return regulation. Restructured markets provide strong incentives for sound investments.
- **Simplicity**: ordinarily, electricity markets are complex because of the complex engineering and economic problems that must be solved. In-spite of all these, designers strive to keep the electricity market designs as simply as possible.
- **Transparency**: electricity markets have a high degree of transparency. Market Rules and their development and reviews are publicly available. Market data are available in real-time and periodically reviewed. The power system expansion and operation planning processes also have a high level of transparency. Transparency helps identify and address problems, it also supports efficient operation and investments.
- **Fairness**: a key element of fairness is equal treatment and open access to the market. Fairness is encouraged with the independence of the System Operator and a governance structure that includes representation of all stakeholders.
- **Affordability**: market designs should not only focus on reliability, adequacy and security of power supply, but also on affordability of the service by consumers.
- **Economic efficiency**: electricity market should be designed such that the price signal should not only encourage investments in power generation, but should also encourage consumers to consume electricity, while discouraging wasteful consumption of electricity. In other words, the design of the market should be such that market should provide the investors with adequate

returns on investments to encourage investment, and at the same time make the services affordable by the consumers to encourage responsible consumption. Also, the market should be such that inappropriate behaviour by market participants should be inherently discouraged.

Electricity markets differ in their designs in different countries and regions. There are two broad types of market 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.

The ECOWAS Electricity Market is currently being developed to enable the sustainable operation of an efficient, harmonized and coupled Wholesale Regional Electricity Market. The introduction of the Regional Electricity Market will result in enhanced cross-border trading, with increasing challenge of detecting possible market misconducts. Therefore be need for higher surveillance activities on the part of the regulators (national and regional) to ensure the increasing challenge is contained on time. 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). A number of 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

The essence of this assignment is for the Consultant to assist ERERA in developing and adopting effective Rules and Procedures for Market Surveillance, to support an efficient and reliable regional electricity market, based on international and regional best practices, subject to the Regional Market Rules (RMR). The Procedures describe how the SMO will carry out its obligations under the RMR in monitoring market participants' behavior in compliance with the Rules, WAPP Operation Manual and the Market Procedures. For this purpose, it is important to:

a. Review the Market Documents above to identify the Functions, for the development and efficient operation of a Regional Market. Viable Functions, based on best practices, outside the Market Documents, should also be identified and proposed.

b. Specify indicators consistent with the identified Functions, to monitor the adequacy and efficiency of the operating Rules and Procedures, as well as monitor the performance and behavior of market participants and performance of the market, with respect to the provisions of these Rules and Procedures.

These Functional Indicators will form the basis for the Regional Electricity Market Surveillance at the macro level. Market Surveillance, in particular, plays a significant role in anticipating the potential vulnerabilities to the Electricity Market. It is a pre-emptive measure aimed at detecting and deterring potential market abuse, including market manipulations, insider trading and market power (which is the ability to control prices, either alone or in a collusive arrangement, like a cartel). Market Surveillance entails monitoring of compliance by all Market Participants, including the Market Service Providers, with the market policies, regulations and procedures as provided in the Market Documents. The market monitoring concept is used for policing and securing the integrity of the electricity market. The responsibilities of the Market Monitoring Entity (or the Market Surveillance Authority) is to observe the market, identify problems and suggest improvements or implement sanctions. Market Surveillance includes the evaluation of submitted market data. A high degree of transparency of the Wholesale Electricity Market reduces the risks of market distortion and interference with price signals and ensures that end consumers pay a fair price for electricity supplied. A key component of Market Surveillance is the investigation of the Market Design to ensure that there are no flaws, which Participants can capitalize on and take advantage of, to manipulate and game the Market.

This Report deals with the review of the design of the ECOWAS Regional Electricity Market, as well as the review of the design of the Electricity Market in the developed Regions. It also shows a comparative analysis of the two market designs, highlighting the key lessons, challenges to the design of ECOWAS Regional Electricity Market and recommendations for the enhancement of the ECOWAS REM design. The Report also presents the key Functions for the Regional Electricity Market, as provided in the Market Documents and highlights the Indicators to monitor the implementation of the Functions.

This Report also forms the basis for the draft Rules and Procedures for Market Surveillance which is presented as a separate deliverable. The Rules and Procedures highlight the prohibited activities, roles of the various stakeholders, reporting obligations, data management as well as enforcement and sanctions

3.2 Objectives of the Rules and Procedures

The key mandate of ERERA, granted by Article 3 of Regulation C/REG.27/12/07 on the Composition, Organization, Functions and Operations of ERERA, are related to ensuring effective and efficient functioning of the regional electricity market. This includes the monitoring of the level of transparency and competition in the electricity market, as well as compliance with the Market Regulations. In accordance with this mandate, this document describes the indicators for market surveillance at the micro level, the benchmarks, precise data requirements for market surveillance at the micro level, data collection and validation procedures, monitoring procedures, and the regulatory actions in case of breaches of any of the Market Regulations, in the ECOWAS electricity market.

3.3 Methodology

The methodology for developing the Rules and Procedures for the Regional Market Surveillance include:

- Review of the regional electricity market design upon which development of the Electricity Market Documents are based. Other regional market designs were also reviewed, for best practices, to compare with the ECOWAS regional market design. The outcome of the comparison highlighted some challenges to the design of the ECOWAS regional market, as well as recommendations for addressing the challenges.
- Review of the Regional Market Documents to identify the Market Functions for reliable operation of WAPP interconnected power system, and the Market Functions for the efficient operation of the regional electricity market, as well as the associated indicators for market surveillance at the macro level. Availability of these market documents is a condition precedent (CP) for the commencement of the ECOWAS Regional Electricity Market.
- Determination of the data for market surveillance at the micro level, through data activities.
- Establishment of stakeholder roles and relationships in market surveillance, including Investigations and Enforcements.

4. Policy and Legal framework for Market Surveillance in the ECOWAS Regional Electricity Market

4.1 Policy Imperatives of Electricity Market Surveillance

The ECOWAS Energy Protocol was enacted in 2003 by the ECOWAS Heads of States and Government and serves as the overarching policy document on which the development and proper functioning of the regional electricity market stands. The Protocol not only provides the basis for the facilitation of investments and trade in the regional electricity market but also specifically promotes free trade through the prohibition of anti-discriminatory rules and practices as well as anti-competitive behaviors of contracting parties.

Specifically, Article 6 (1) of the Energy Protocol provides that "each Contracting Party shall work to alleviate market distortions and barriers to competition in Economic Activity in the Energy Sector"[2]. Article 6(2) of the Protocol empowers state actors to monitor and enforce laws against anti-competitive behavior in their respective jurisdictions and specifically provides that "each Contracting Party shall ensure that within its jurisdiction it has and enforces such laws as are necessary and appropriate to address unilateral and concerted anticompetitive conduct in Economic Activity in the Energy Sector"[3].

More detailed provisions are made in other sub-articles under Article 6 to ensure the cooperation of all relevant parties in the region to monitor and enforce adherence to rules and regulations that are established to ensure the efficient function of the market and the prohibition of all anti-competitive

[2] Article 6 (1), ECOWAS Energy Protocol, 2003

[3] Article 6 (2), ECOWAS Energy Protocol 2003

behaviors, market distortions and other activities that will impede the sustainable development of the market.

Article 7 of the Protocol also provides for unfettered transit of energy products across the region and prohibits any actions or practices that prohibits or limits such transits. There is also a mandate for the enforcement of this provision by relevant regional and national institutions.

4.2 Legal Overview for ECOWAS Electricity Market Surveillance

ERERA's legal mandate as regional regulator are clearly established in the ECOWAS Regulation C/REG.27/12/07 on the Composition, Organization, Functions and Operations of ERERA. The power of ERERA as regional regulator with regards to market monitoring and surveillance are provided for under this Regulation.

Article 16 (3) of the Regulation provides as follows:

"ERERA shall be responsible for the technical regulation of regional power pooling and the monitoring of regional market operations such as:

(a) respect of technical and commercial regulations, more especially the conditions for access to the interconnected transmission network, entry of operators into the market and development of transmission infrastructure;
(b) prevention and sanction for anti-competitive practices, abuse of dominant position and conditions that could affect the proper operation of the regional electricity market."[4]

Article 18 of the Regulation also gives ERERA the necessary powers to ensure that the provisions of Article 16 are adhered to by providing that ERERA shall "prevent and/or sanction defaulters of ant-competitive practices, abuse of dominant position and all other violations of market operations rules or licenses or authorizations and when necessary, initiate process to enforce compliance in case on non-execution of sanctions".[5]

The legal provisions above provides ERERA with the legal basis for the enactment of the Rules and Procedures for the Surveillance of the ECOWAS Regional Electricity Market.

5 Review of the ECOWAS Regional Electricity Market Design

The design of electricity market is characterised by the structure of the market, its architecture and the rules governing the operation of the market. The review of the regional electricity market design is therefore carried out along these design characteristics. It is however instructive to start this exercise with the review of the regional electricity market landscape, to understand the composition of the market, capacities and sizes of the elements of the market.

5.1. Regional Electricity Market Landscape

The Regional Electricity Market 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

[4] Article 16(3) Regulation C/REG.27/12/07 on the Composition, Organisation, Functions & Operations of ERERA

[5] Article 18(3) Regulation C/REG.27/12/07 on the Composition, Organisation, Functions & Operations of ERERA

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.

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. 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 in accordance with 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 Member States. The slow evolution of regional trading is mainly due to lack of transmission links and 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. Briefs on the functional elements of the regional power system are discussed below.

5.1.1. 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 reserve margin in this generation capacity, as there is still a capacity shortfall in the region. Reserve margin is the amount of electric generating capacity that exceeds 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.

5.1.2. Transmission System

The transmission system in the region consists of interconnection of substations and high voltage lines. The transmission voltages in the region range between 66 kilovolts (kV) and 330 kV. The national and regional power systems consist of many load centers 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 the national networks than in the regional interconnections.

5.1.3. Distribution System

The distribution systems throughout the region are designed either as radial or loop networks. A radial distribution network consists of a number of 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 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, they respond to customers' requests for service and maintenance, and they also provide the bulk of the metering and billing services.

5.2. Market Structure

The electricity utilities of most ECOWAS member states are vertically integrated. It is likely that this will 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, including the conditions precedent for transition from one phase to the next
- The Market Participants
- The Financing Structure
- Generation technology mix
- The Market Service Providers
- The Regional Transmission Network

5.2.1. Market Phases

The ECOWAS Regional Electricity Market was designed to develop in three phases, namely phase 1, phase 2 and phase 3. During the transitions from phase 1 up to phase 3, the market is designed to grow in all the design characteristics – the Market Structure should become more robust, the Market Architecture and Trading Arrangement should expand, and the Market Rules should equally evolve to capture the changes in the Market Structure and in the Market Architecture/Trading Arrangement during the intervening period. In discussing the different stages of development, 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. These stages in Market Development are included in the regional Market Design. The current situation where some trades are carried out using the existing transmission infrastructure and negotiated on case-by-case basis is expected to evolve through different stages until the end stage comprising of a liquid and competitive market, with different products to be traded, is achieved.

5.2.2. Market Participants

During the phase 1 market, the market participants in the regional market will be the entities approved by the countries, one entity per country, representing the country's power sector. This is because most of the utilities in the region are vertically integrated utilities under the state ownership and management. An IPP with a cross-border Agreement can be considered a Market participant in this phase. However, for a country like Nigeria, where the generation and distribution assets have, apart

from being vertically unbundled, have also been horizontally unbundled and privatized, any of the distribution or generation companies can be registered as a participant, and there may be more than one entity in the market from the country. In terms of market players, the participants are the Generators and the Load Participants, such as distribution companies, Load Serving Entities, Eligible Customers, etc.

5.2.3. Generation Technology and Ownership

Key considerations for electricity Market structure are those properties of the market closely tied to technology and ownership of the elements for power generation, transmission and distribution. From the market design, electricity generation in the region will be contributed by the thermal generators (i.e. gas, oil, diesel, coal and nuclear), hydro generators and the renewable energy sources. At the moment, the distribution of technologies for power generation in West Africa is:

- Predominantly thermal (gas, oil and diesel)
- Substantial hydro contribution
- The contribution of the renewable energy sources is low, but increasing in penetration
- Coal and Nuclear generation are non-existent in the energy mix for the region at the moment but is expected to be part of the future energy mix, given the substantial coal and uranium deposits in the Region. The use of coal may however be impeded as a result of clean energy concerns

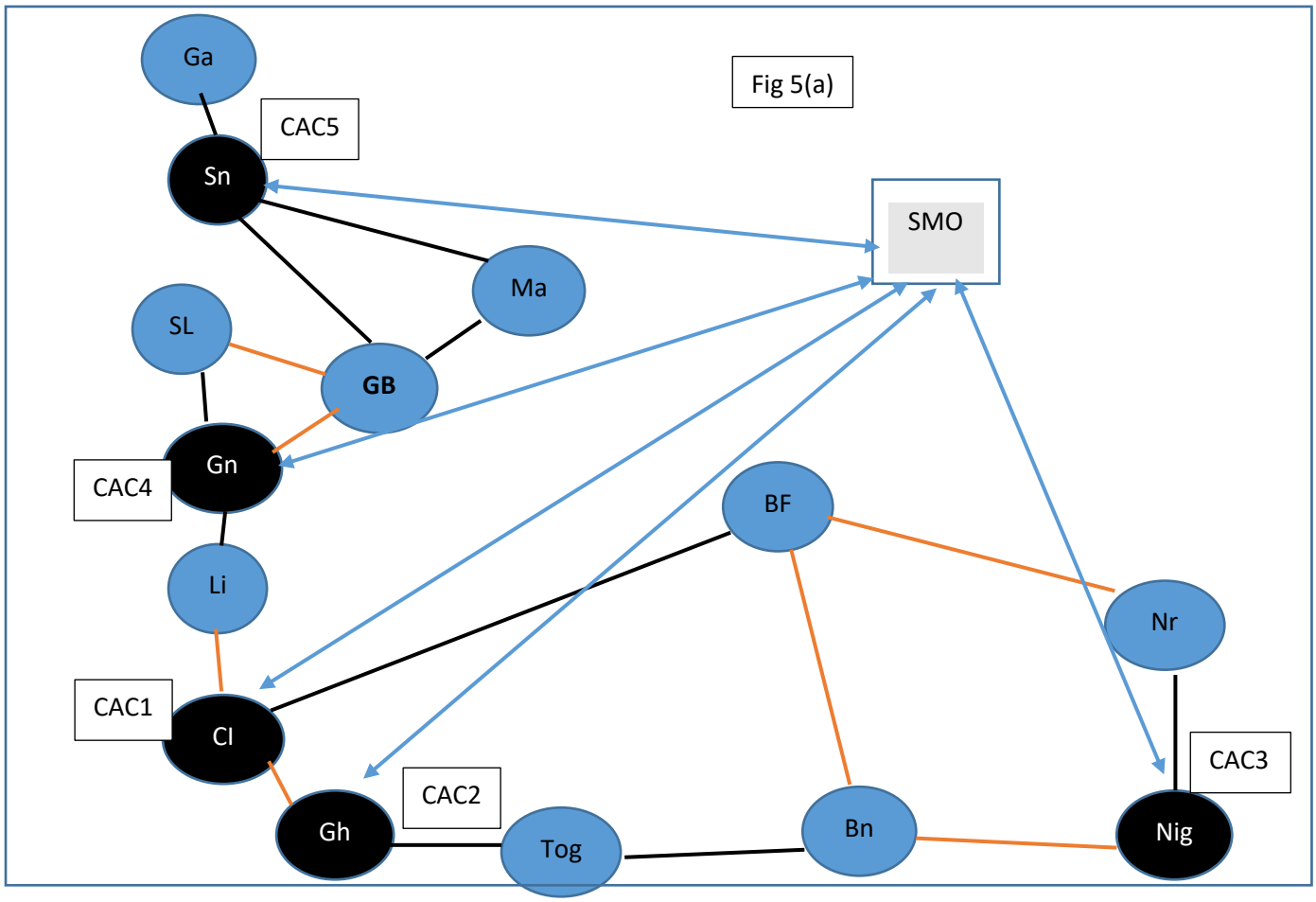
In terms of ownership, the structure of the ECOWAS Regional Market is as follows:

- Some of the gas fired plants are 100% private or 100% government, while others are partly government and partly private. In line with the market design, private generating plants will dominate the landscape, going forward
- The hydro plants are 100% owned by governments and will remain so for a long time, because of the huge resources involved in development of Hydro generation, and the issues involved in the management of water resources, especially those waters shared by a number of countries (eg River Niger).
- Some of the distribution companies are clearly delineated, like in Nigeria, Ghana, and Cote d' Ivoire. For most countries, the distribution companies are embedded in the vertically integrated utilities, such as Togo, Benin, Niger Republic, Mali, etc. In Nigeria, Distribution companies are partly private and partly government, while they are 100% government owned in other countries. The market design envisages more unbundling of the utilities and privatization of more distribution companies as the regional market grows
- The transmission network, System Operations and Market Operations are owned and administered by the governments of Member States. The market design provides for the emergence of privately financed and owned transmission network, but the System Operations and Market Operations functions will remain under the government ownership and management.

Regulation should make sure that none of the generators is big enough to constitute a threat to the health and efficient operation 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.

5.2.4. Financing Structure

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 the 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, and market efficiency. The market design envisages an increasing private sector investment and participation in the regional electricity market. The structure for the regional electricity market can be represented by the figures below:



Key

Nig = Nigeria, Nr = Niger, Bn = Benin Republic, Tog = Togo, Gh = Ghana, BF = Burkina Faso, Cote d'Ivoire
Li = Liberia, 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 5(a) above shows the fourteen national markets and systems in 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.

Figure 5(b) below shows the structure of the regional electricity market with the Sellers and Buyers as the Market Participants, and the System Market Operator (SMO), Domestic Transmission System operators (DTSO) and the Control Areas as the Market Service Providers. The figure also shows the transmission interlink enabling the cross-border transactions, as well as the instrument for the transactions (Bilateral Agreements).

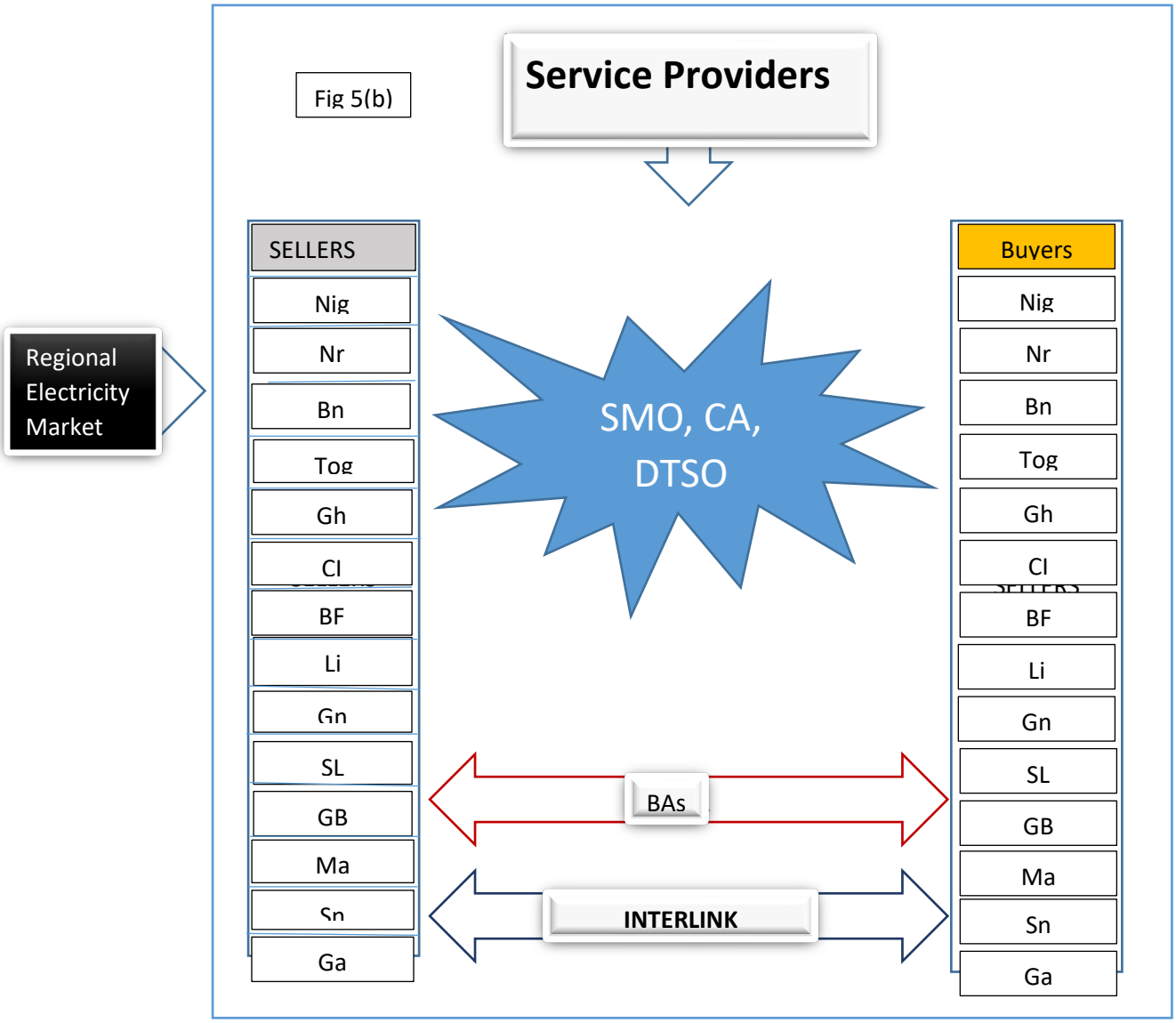


Fig 5(b) shows that there may be Buyers and Sellers in the same country. In fact there may be multiples of such participants in each country. The sizes of the participants will be regulated to ensure that none is big enough to influence prices and quantities of the product in the regional market.

Whereas the responsibilities of the Sellers are to produce, sell and inject electricity into the regional grid, the Buyers are to purchase and off-take electricity from the Sellers using the Bilateral Agreements. The roles of the Market Service Providers in the Regional Electricity Market are as follows:

5.2.5. Market Service Providers

5.2.5.1. The System Market Operator (SMO)

The SMO is the regional market service provider responsible to the Regional Regulator (ERERA) and designated to play the roles of the administrator of the Market Rules and the WAPP Operating Procedures. The SMO ensures the technical stability of the Regional Electricity Market and the commercial stability of the electricity market, as its key responsibilities. The SMO also carries out the day-ahead scheduling of generation and the real-time dispatch operation in the market.

According to the market design, the SMO is also responsible for carrying out the following roles in the Regional Electricity Market, when fully developed (i.e., in phase 2):

- Day-to-day administration of the regional market (bilateral market, day – ahead market, etc)
- Administration of the day-ahead market (receive bids and offers, clear the market, set the next day program of cross-border transaction, etc.)
- Settlement of the market fees including other charges such as fees for services, transmission payments, Regulatory fees, etc.
- Settlement of imbalances
- Monitoring load flows and taking action on variances (coordinating Control Areas / TSOs efforts to maintain flows)
- Market Monitoring and surveillance
- Administration of contracts
- Dispute Management at an operational level for solving operational disputes
- Administration of Meter Reading and commercial data bases
- Management of settlement, billing, payment processes, including the day-ahead market transactions
- General administration of the institution (HR, financial administration, etc)
- Collaboration with other regional institutions (WAPP General Secretariat, ERERA)

These functions are typical of the Market Operator, but the SMO also performs some functions typical of the System Operator. These functions include:

- Operational planning of Interconnectors and congestion management
- Coordination with the Control Areas for the use of the Interconnectors, and ensure optimum utilization
- Overview of flows in the interconnectors, and collaboration with the Control Areas to maintain scheduled flows

- Allocation of transmission capacity in the Interconnectors. In order to avoid the situation where a Market participant allocated transmission capacity does not use it and blocks this capacity or sells it, the following conditions are provided in the design document:
    - The transmission capacity allocated cannot be transferred
    - The transmission capacity allocated has to be used by the one to whom it was allocated (a party in the bilateral contract)
    - If the transmission capacity allocated to a participant is not used or partly used, the participant has to declare it to the SMO and make it available for others. It is for this reason that parties in bilateral contracts have to communicate daily with the SMO on the use they will make of the transmission capacity, so as to ensure that unused capacity is put to use
    - The SMO and ERERA have the powers to monitor and investigate the behaviour of market participants regarding how they use their allocated transmission capacity, and if they are declaring correctly ex-ante the use of this capacity. This also borders on market surveillance to prevent abuses in the market

It should also be pointed out that the SMO may delegate any of its functions to a person or a body competent to exercise the said function. Such delegation shall be with the prior approval of ERERA, and any function performed by a delegate is to be taken as being performed by the SMO.

"The SMO shall report to ERERA and the WAPP Executive Board as follows:

- An Annual report of activities including market performance, financial statements and operational disputes no later than June 30 of the following year
- A summarised report on market evolution to be produced every four months
- Any other report on specific issues that may be required by the WAPP Executive Board or ERERA

The above reports, as well as any others necessary for the proper functioning of the market, which is not confidential, will be made available to market participants and national Regulators by the SMO through its website"[6].

For the purpose of market monitoring, the SMO, within six months of the RMR approval, shall develop and submit for ERERA's approval the Market Monitoring Procedure, whose purpose is to establish the mechanism by which the SMO shall verify that all Participants comply with the Market Rules and Market Procedures. "The market monitoring procedure should specify:

- the SMO's monitoring processes for assessing compliance by all Participants with the RMR and Market Procedures;
- a process for market participants to report breaches of the RMR or Market Procedures;
- processes for investigations into alleged breaches of the RMR or Market Procedures;
- the procedure for bringing proceedings in respect of market rules breaches before ERERA in line with ERERA's Dispute Resolution Procedure.

[6] Art. 19 (Reporting) "Regional Market Rules for West African Power Pool", August, 2015

Where breaches in the RMR have been identified or where there is a reasonable concern that the RMR have been breached, all documentation relating to the matter will be provided to ERERA to adjudicate and to take necessary action"[7].

The Market Monitoring Procedures has since been developed by the SMO and was approved by ERERA in 2020.

5.2.5.2. Control Areas (CA)

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 are also responsible to the Regional Regulator (ERERA). In line with the provisions of the WAPP Operation Manual, there are five such Control Areas within ECOWAS Electricity Market, listed as follows:

- 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

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 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. Other operational roles of the Control Areas in the Regional Electricity Market are as follows:

- Coordination of operations with domestic TSOs in their specific areas, in such a way that the flows in the interconnectors are maintained according to schedule
- Ensuring that seamless inter- and intra-Area flows are maintained
- Ensuring safe operation within the Control Area
- Maintaining constant communication with the SMO to ensure flows in the interconnectors
- Collaborating with SMO on the operational planning of interconnectors
- Coordinating with neighbouring Control Areas and TSOs within its area in cases of emergencies
- Complying with the SMO's restoration procedures in case of emergencies within the Control Area
- The Control Areas will report periodically to the SMO within the period specified by the SMO. The contents of the periodic reports will be established by the SMO

*5.2.5.3. Domestic Transmission System Operators (*DTSOs*)*

The DTSOs are the Transmission System Operators for the power systems of the different member states. The DTSOs are also designated to play roles in the Regional Electricity Market (REM). For the

[7] Art. 20 (Market Monitoring), "Regional Market Rules for West African Power Pool", August, 2015

national power systems, the DTSOs are responsible to the National Regulatory Authorities (NRA), while they are responsible to ERERA for the Regional Electricity Market.

The key tasks of Domestic TSOs with regard to the Regional Market Operations are to ensure that:

- Flows agreed at regional level are maintained in the interconnectors under its responsibility
- Technical parameters (such as voltage, frequency, load, etc) are maintained in the interconnectors under its responsibility
- Domestic system is operated safely to avoid having undue impacts in neighbouring systems
- Support in emergencies for neighbouring systems is provided when possible
- Required communications is maintained with the Control Area responsible for its area and that there is due compliance with instructions
- Required communications is maintained with the SMO

5.3. Market Architecture

Market architecture consists of the map of component sub-markets in the electricity market, as well as the types of the 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, include:

a. Bi-lateral Market: This type of market, also referred to as "Over the Counter Market" is driven by Bilateral Contracts or Agreements, between two parties. Bilateral Contracts (BC) will be responsible for about 85% of the total transactions in the regional wholesale electricity market. The BCs can be long-term, medium or short-term. The regulator will approve the templates to be used for trading, and market participants will make every reasonable effort to use the templates, since these will minimize transaction costs and simplify the work of the SMO. The template agreements for the REM have already been developed and approved by ERERA.

b. Spot or Balancing market (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 Regional Electricity Market. The Spot Market is necessary to ensure that those generators that may not be contracted under the Bi-literal Agreements are provided for in the electricity market, which will provide an incentive to generator developers. These generators will be used for Balancing Services.

   Whereas in the day-ahead market, participants submit bids and offers for energy and capacity for each hour of the next day, the real-time market is a bid-based market, with security-constrained economic dispatch, that is conducted at least every 5 minutes throughout the day (to meet an urgent generation need). The outcome of the real-time market is the efficient physical dispatch of resources, together with 5-minute prices at each location.

c. Capacity Markets: The purpose of the capacity market is to ensure that enough capacity is built and maintained to meet future adequacy needs of the region. The capacity 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, market for reserve power services for frequency control, and market for Black Start services for restarting the grid in case of total or partial grid failure.

5.4. The Regional Market Rules

The Market Rules is a manual of commercial codes for the efficient and transparent operation of the Regional Electricity Market. It is developed by WAPP and approved by ERERA, for the day-to-day operations and administration of the Regional Electricity Market. The Regional Market Rules (RMR), along with the other Market Documents, is a Regulatory instrument used by the Regulator to govern the Regional Electricity Market.

Through the reform of the Regional Electricity Market, a number of entities were created to participate and provide services in the Market. These Rules establish and formalize the relationships, and interactions, rights and obligations between the Market Participants and the Market Service Providers, as well as between the Market Service Providers themselves. The Rules establish the general procedures and principles to administer the wholesale electricity market. All those to conduct trading in the Regional Electricity Market must be bound by the Rules, and also by the higher hierarchical framework (e.g. the Acts and the licence conditions, as applicable). An organised electricity market cannot exist without Rules, which are mandatory for all trading and providing services in the market. In fact, the design of the Regional Electricity Market is encapsulated in the Regional Market Rules.

The Regional Market Rules define the general framework to enter, participate and trade in the Regional Electricity Market that, in principle, is non-discriminatory, promotes economic efficiency and creates sufficient predictability and transparency to provide comfort and security to investors. The RMR will need to be amended from time to time and, as part of its transparency and predictability characteristics, the amendment process will be through a regulated procedure established in the Regional Market Rules that ensures adequate participation and consultation with all affected parties.

For the complete understanding of the Regional Market Rules, and of the operation of the Regional Electricity Market, most of the Market Documents [e.g., Operation Manual, Metering Code, Regional Market Procedures, etc.] must be read in conjunction with one another. There are cross references in these documentations.

5.4.1. Objectives of the Regional Market Rules

The key objectives of the Regional Market Rules, according to the Regional Market Design are:

- To establish and govern an efficient, reliable and competitive electricity market for the sale and purchase of wholesale electricity and ancillary services in the region
- To provide the framework for an efficient, competitive, transparent and reliable wholesale electricity market
- To set the responsibilities of the participants, the SMO, Control Areas (CAs) and Domestic Transmission System Operators (DTSOs) in relation to trading, dispatch and contract nomination, pricing of imbalances, ancillary services, metering, settlements and payments

- To establish a governance mechanism and a market monitoring system
- To provide a framework for the resolution of disputes between Participants or between the Participants and the Service Providers
- To provide an efficient and transparent process for amending the RMR and the WAPP Operational Manual

5.4.2. Market Rules in a Hierarchical system of the Regional Market

An organised electricity market is characterised by a hierarchical regulatory framework. Each level in this hierarchy has increasing details and is subject to the provisions and conditions established in the higher levels. The hierarchical regulatory framework for the regional market consists, by decreasing priority, of the following levels:

- The legal framework, principally the Act (the ERERA Supplementary Act and Operations Regulation)
- The licence conditions, authorisation and transmission tariff methodology, to regulate activities and tariffs
- The rules to participate, administer and settle the Regional Electricity Market (RMR, Operational Manual)
- The detailed methodologies to implement the rules (the Regional Market Procedures, Operation Procedures))
- The commercial metering systems, settlement system and payment system used by the System Market Operator to operate and administer the Regional Market Rules.

Consistent with the hierarchy, any conflict between a provision in the Regional Market Rules or the WAPP Operational Manual and the Act or licence conditions, the Act or licence conditions, as applicable, shall prevail. For the administration of this situation, Rules are added, to ensure that all remaining Rules, remain applicable and enforceable. Any conflict between the RMR or the WAPP Operational Manual and any agreement, including connection agreements, Ancillary Services agreements and Power Purchase Agreements or contracts, the RMR and Operational Manual prevail.

5.4.3. Applicability of the Regional Market Rules

The Regional Market Rules applies to

- The Market Participants:
  - The Generators
  - Distribution Companies
  - The Load Serving Entities
  - The Eligible Customers
- The Market Service Providers - The SMO, CAs and DTSOs

Participation in the Regional Market is established by the instrumentality of a Participation Agreement, which establishes participant's agreement to comply with the provisions of the Regional Market Rules. The Rules compliment and supplement the WAPP Operational Manual. The two

documents constitute the Rules for planning, dispatch, and operation of the system and the administration of the ECOWAS Regional Electricity Market. Procedures and processes are put in place for the System Market Operator to be able to operate within these rules, and to enable a feasible and transparent implementation of the Regional Market.

5.5. Market Governance

The regional market design recognized the fact that market governance is a critical element in establishing the credibility of the electricity market in the perception of both the Market Participants and the external investors, financial institutions and trading partners. The governance structure must encourage strong surveillance and enforcement mechanisms to ensure fairness and integrity of the market.

Part of the market governance structure is an independent regulator that has the overall oversight responsibility of the regional market, including responsibility for market surveillance, enforcement and dispute resolutions. Market governance is a critical component of the RMR, and generally deals with issues related to:

- Regional Institutions: relationship among them and with Domestic Authorities
- Regulation: roles and responsibilities of the regional regulator
- Market Operations: allocation of responsibilities
- Market Surveillance and Monitoring

6. Review of the Design of Developed Regional Electricity Markets

6.1. Introduction

Market design documents from other regions were reviewed for a comparative analysis with the ECOWAS REM design. The market designs reviewed include designs from Southern Africa, Europe, Australia and America. As with the ECOWAS Region, it was noted from the reviews that the goal of all electricity systems, whether regional or national, is to ensure the reliable delivery of electricity at the lowest possible cost to consumers. This goal is rooted in the regulatory principles that influence price setting, prescribe the conditions for entry into the market and obligate a utility to provide service.

The reviews noted that wholesale electricity market refers to the exchange of energy, capacity and ancillary services in the bulk power system, which comprises the interconnected resources at high voltage level – generation, transmission and load serving entities. The retail power market refers to the exchange of energy and services at lower voltage distribution level. A component of the wholesale market known as the coordination service, comprising of the system operations and market operations services is responsible for ensuring both technical and commercial stability of the wholesale market. Resource adequacy – i.e. having enough available capacity in the system – is required to reliably meet load at all times. This includes adequate transmission capacity which is also required to ensure that energy is delivered to where it is needed. Because electricity demand is relatively variable in time and uncertain in quantity, both generation and transmission must be constantly coordinated to meet load in a reliable manner.

The prerequisites for a wholesale power market to be established and operated effectively, is quite much, and is only met by a relatively small proportion of the developing countries. These conditions may be grouped into:

- Financial sustainability of the power sector so that entities are sufficiently credit-worthy to provide payment securities
- The scale and structure of the generation segment and its ability to support competition
- The quality of the institutions available to oversee and regulate the functioning of a complex market
- Broader economic, political, and social conditions of the country to support and pay for electricity consumption

The reviews also showed that to achieve the system requirement necessary to support the security and reliability of the electric grid, adequate market regulation must be drafted to address the issue of financial sustainability of the power sector, so that entities are sufficiently credit worthy to provide payment security. Ideally, these regulations will provide sufficient opportunity for generators to recover both fixed and variable costs if they contribute to resource adequacy and promote the construction and upkeep of a viable transmission network. Simultaneously, these regulations must avoid incentivizing an overbuilt system or overcompensating inefficient units.

It was also shown that energy systems across the world are undergoing fundamental changes due to the climate change concerns and the growing energy security concerns over the dependency of the energy systems on fossil fuels which exhibit a continuously reducing availability, and continuous increase in prices. Renewable energy sources are currently addressing the concerns of climate change and energy security. The majority of the renewable energy sources are wind and solar generation technologies, which are inherently characterized by high variability and limited predictability and controllability. Their power output is not only extremely variable, but also zero during periods of low wind speed or no sunshine. With the increased share of renewables in the capacity mix, any imbalance between supply and demand will change system frequency more rapidly than in the current system, thereby challenging the stability of the power system.

Again, massive deployment of renewable energy sources will lead to a massive reduction of energy production cost (due to low or zero production costs of renewable generation) accompanied by a massive increase in the cost of balancing services (due to inherent variability and intermittency of renewable generation), and new investments (due to the need for new generation and network assets to support system balancing). **This implies that a new market design is required to achieve large scale implementation of renewable energy sources**. This design must be achieved in a cost-effective manner, making use of the flexibility produced by new technologies like Demand-side Response (DSR) and Energy Storage (ES) that are already in use.

Prevention of market manipulations and abusive practices start with the design of the market, at the various levels of the design characteristics. With properly designed markets, Market Surveillance is reduced to mere monitoring of the performance of the market and behaviour of the Market Participants to ensure compliance with the provisions of the Market Design. Electricity market design process takes place through explicit regulatory actions that set the rules for how market participants connect to the network, payment for electricity injected into the grid, and payment for electricity withdrawn from the grid.

The challenge of appropriate market design becomes more apparent at this current time, where assets such as variable renewable energy resources, demand response infrastructure, energy storage infrastructure and distributed generation facilities play critical roles in addressing the climate change and energy security concerns.

This review of other Regional Market Designs was carried out from the point of view of the market design objectives, the guiding principles for the design, the structure of the market, the architecture and the rules for operating in the markets. The main objective of this review is to draw some lessons that will guide in developing recommendations for the enhancement of the ECOWAS REM design. The outcomes of the review are summarized below.

6.2. The Objectives of the design

Some of the objectives of the traditional market design are:

- Promoting efficient operation of the power system
- Creating clear and effective incentives for investments in the power system
- Improving reliability and cost-effectiveness of electricity service

These objectives have driven the power market designs for decades. Other objectives have emerged in recent times that have substantially impacted the power market design. These are:

- Reducing the adverse health and environmental impacts of electricity service
- Rapidly expanding energy access to unserved and under-served customers
- Encouraging innovations in power systems

In summary therefore, electricity market design should achieve power system reliability, energy security, supply affordability and reduced health and environmental impacts, in two distinct ways:

- Operational: in operational sense, electricity market design defines the protocols for dispatching electricity in a reliable and economic fashion
- Financial: at the same time, market design should determine the long-term landscape of financial incentives and rules of eligibility for investments in resources that ensure a reliable and secure grid

These dual roles of the electricity market (Operational and Financial) are the ultimate defining considerations of the electricity market design

6.3. The Principles of Market Design

There are four key principles that are relevant in guiding the design of electricity markets in the world. These are:

- Promoting short-term market efficiency: Market design should encourage wholesale competition while preserving system reliability. Trading arrangements must ensure efficient and reliable operation of the power system and market, efficiently employing available resources not only to balance aggregate supply and demand, but also to allow congestion management and supply ancillary services.
- Enabling demand-side participation: Market design should ensure strong participation of the demand side of the market. At least, large customers should participate in the wholesale market. Direct contracting between large customers and generating companies is feasible, even if supply of households and other small customers remain regulated. Furthermore,

increased demand participation has positive effects in mitigating market power and providing flexibility to the system for increased integration of variable renewable energy sources.

- Providing open access: Open access to the grid system is an essential element of introducing competition to electricity markets and of increasing their efficiency. Competition requires that investors in new supply capacity face no barriers to entry to the wholesale power market. Third party access should allow entry by new types of suppliers, including industries that own power generators to meet their own power needs and have the capacity to sell excess power from these plants.
- Ensuring supply adequacy: Developing countries require a workable framework for long-term supply adequacy, ensuring adequate capacity to meet demand without experiencing supply constraints. The market must provide signals and incentives for investments in new generation capacity when needed.

These objectives and principles of market design are substantially generic. The differences from one market to the other can be found in the characteristics of the actual design – the structure, architecture and the rules.

The summary of the outcomes of the review of the Market Design Documents for the other regions, from the point of view of the market structure, architecture and the rules are discussed below.

6.4. Market Structure

As stated earlier, 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. Poor market structure poses the greatest threat to the health of power markets and provides the incentive for reform.

Market structure has a decisive impact on market power and investments. The more the participants, the less the incentives for market power and the more competition and investment inflow. The industry financing structure is another component of the market structure, and this determines the cost of generation and transmission in the electricity market.

Market structure includes the arrangement and capacity of the transmission lines. Insufficient capacity can cause bottlenecks and local market power, while additional capacity can expand the size of the market and reduce the possibility for market power.

The cornerstone of a restructured electricity market (as in some other regions) is the wholesale market, in which the generators compete to serve load (demand side of the market). In the restructured market, generation is effectively unbundled from the electricity utility. This allows the generators to operate in a competitive market, in which they make their own investment decisions, and stand to gain or lose based on how those decisions turn out.

In most cases, the market structure is designed for a public grid infrastructure operated by a system operator (SO), whose responsibility it is to keep the grid stable by preserving the frequency within a certain bandwidth. The SO can operate a region-wide network or a nation-wide network. With this structure, everyone connected to the grid is a market participant. The produced or consumed

electricity is measured with an electricity meter over a period of time that may be consistent with the settlement cycle.

6.4.1. Scale, scope and structure of the generation and transmission segments of the power system

The number and sizes of each type of market participants are key regulatory decisions to make, in order to avoid poor market design. The power system needs to be large enough to accommodate many buyers and many sellers. "A power system of size 1000MW is currently accepted as a valid threshold below which unbundling may not be advisable, let alone wholesale competition"[8]. To begin with, the system must be large enough to accommodate a significant number of generating plants. Furthermore, there are fixed costs associated with the establishment of a wholesale market, including the development of associated institutions and technology platforms, which only sizable markets can efficiently support. "It follows that the balance between costs and benefits will become more attractive at larger system sizes, potentially 3000MW and beyond"[9]. It is recommended that countries facing serious adequacy problems should address the lack of investments in new generation capacity before considering the introduction of wholesale competition. This is where regional markets with cross-border trades provide some advantages over national markets.

Rather than the market size, the main constraint on the feasibility of wholesale market to operate, is the ability of generating companies to enter the market, access transmission resources on a non-discriminatory basis and enter into enforceable contracts with new or existing buyers. Transmission is a critical element of the market structure, which plays the crucial role of moving the traded power in the wholesale market from the power plants to the load participants, some of which are distribution companies, operating at medium and low voltages that bring electricity to the consumers' homes and businesses. The distribution companies remain a monopoly utility in a restructured market. The load participants include the eligible customers or large power consumers, who take power, above a certain thresh hold, directly from the transmission interfaces. The transmission part of the power system enables the wholesale market and determines its size, scope and efficiency. The farther the power plants are from the load centres, the more important it will be to plan carefully the development of the transmission infrastructure. With the growing focus on renewable energy sources (RES), that are frequently located in more remote and less populated areas, the issue of transmission infrastructure development is drawing more attention.

Transmission bottleneck can create market power in generation even in large power systems, with apparently competitive market structure. Countries must ensure that well-functioning transmission grids are in place at the time of reform. Network congestion, barriers to access and vertical integration can lead to market power and limit competition and new participant entry into the market. Serious transmission bottlenecks need to be alleviated before establishing wholesale competition.

Transmission capacity enhances efficiency and reliability of electricity supply, by allowing a better utilization of resources and limits the extent of local market power abuses by generators due to transmission constraints.

[8] H. Rudnick and C. Velasquez, "Taking stock of Wholesale Power Markets in Developing Countries": A Literature Review, June 2018, page 10

[9] H. Rudnick and C. Velasquez, "Taking stock of Wholesale Power Markets in Developing Countries": A Literature Review, June 2018, page 10 & 11

6.4.2. Emerging Technologies in the Wholesale Electricity Market

Apart from the Renewable Energy Sources (RES), the 21st century power system will witness massive deployment of technologies such as Demand-side Response, Distributed Generation (DG) and Distributed Energy Storage (DES) resources in its structure. These technologies have the potential to reduce system costs at the distribution level, where these resources can address congestion, losses and inadequate infrastructure issues. The wholesale market considerations specific to each of these resources are:

a. **Demand-side Response:** Increasing the price responsiveness of electricity demand, either through voluntary reactions to price signals or through contractual commitments to change demand in response to system events, holds promise for reducing system peaks and adding significant flexibility to the grid
b. **Distributed Generation:** Distributed generation (DG), which is generation located within distribution networks or on the customer side of the network, can help decrease transmission and distribution losses and off-set the need to upgrade infrastructure. Another benefit of the DG is that Micro-grids that can dispatch and manage local generation and demand also can and have the infrastructure to interact with the wholesale power market
c. **Distributed Energy Storage:** Distributed Energy Storage (DES) is an asset that can act as a generator, load or alternative to transmission, and can provide significant flexibility for bulk power systems. DES can provide generation, transmission and distribution benefits (depending on where the Storage is located in the distribution network) but can only be classified as one type in most jurisdictions. Generation cost is valued in wholesale power markets, whereas the use of transmission and distribution assets are regulated and rate-based. **These regulated and rate-based assets are not permitted to participate in the energy markets, but provide service in the energy market.**

6.4.3. The Market Participants

a. **The Generators**: These include generators of all the available technologies, such as
    - Thermal generators, including gas, fuel oil, coal, etc, most of which are flexible enough to provide reserve services
    - Hydro generators
    - Nuclear generators, which is an inflexible resource of generation
    - Renewable energy sources, mainly wind and solar, which are substantially variable and unpredictable
    - Power system resources such as Demand-side Response, Distributed Generation and Distributed Energy Storage
b. **The Load Participants**: These are mainly the Distribution Companies, Load-Serving Entities and Eligible Customers, which extract power from the grid system

6.4.4. The Market Service Providers

Electricity Market Designs include the roles of the electricity market service providers, who are not involved in buying and selling of electricity, but in making sure that the electricity market is both technically and commercially stable. Such Market Service Providers include:

- **Market Operator:** who has the responsibility for the day-to-day administration of the market, carrying out the settlement activities and ensuring commercial equilibrium of the electricity market
- **System Operator:** The job of the System Operator is very critical in every electricity market. The System Operator is responsible for day-ahead scheduling of the power generation units, as well as the real-time dispatch of the units. A key role of the System Operator is that of the provision of reserves of various forms, collectively called Ancillary Services, for balancing supply and demand every second and for satisfying power quality issues. Apart from facilities for frequency and voltage control and for maintaining power system reliability, Ancillary Services include the Black Start facilities, for re-starting the grid after a partial or total grid collapse
- **Transmission Service Providers**: The Transmission Service Provider is charged with the following responsibilities in the power market:
    - Maintenance of the Transmission system: process of keeping the Transmission system in good working condition
    - Operations of the Transmission system: process of changing the physical configuration of the Transmission system by switching, to take part of the network into or out of service
    - Expansion & upgrade of the Transmission network: process of evaluating the need for new transmission assets, deciding where and when to build new lines and substations, and upgrading the existing ones, and physically building and commissioning the facilities

6.5. Market Architecture

Market Architecture consists of the map of component sub-markets, in the electricity market, as well as the types of the transactions and contracts driving the market. Wholesale power markets balance supply and demand for power by means of these sub-markets in different time-scales, ranging from real-time balancing operations (spot markets) to long-term contracts. The real-time markets often operate by means of centralized economic dispatch. In the matured wholesale markets, the long-term bilateral markets are complemented by the day-ahead and the real-time markets, to ensure system stability and supply reliability. Various contracts can be employed by market participants on timescales ranging from days and months, a few years (medium term) or even one or two decades (long-term), for operation in the wholesale market.

A range of sub-markets for products other than energy have been developed, including markets for reserves, capacity markets, ancillary services markets and the market for transmission rights. Analysing wholesale power markets require addressing each of the sub-markets, as well as the overall structure of the market and the interactions between the sub-markets. Multiple trading arrangements apply to different sub-markets ranging from bilateral to centralized markets. Some of these submarkets are described below.

6.5.1. Energy Market

The wholesale energy market comprises the central transaction platform in the power markets. In all cases, energy market attempts to arrive at an economic allocation of generator dispatch that meets

demand and satisfies security constraints. In most cases, energy markets consist of two-settlement markets, where electricity is procured in a day-ahead market followed by a real-time market, which meets any imbalances that occur.

A forward energy market sells energy to load-serving entities (LSE) and buys from sellers, in advance of time when the energy is produced and consumed. The day-ahead market is important because it provides a hedge against price volatility in the real-time markets caused by load forecast errors, generator outages, or other imbalances. The real-time market (RTM) reflects the actual operation of the resources operating in the market.

The locational marginal price (LMP) is the price paid to the generators and is set by the marginal costs to supply the LSEs in particular locations. If congestion restricts sending lowest cost electricity to a particular location, higher-priced electricity is dispatched, and the higher price is reflected in the LMP. Generators have financial schedules in the day-ahead market that are paid as the day-ahead LMPs, and any additional generation they are asked to provide in real-time is paid the real-time LMP. Generators and loads have the option to settle outside the spot market, through bilateral contracts in the wholesale market.

To deliver energy when it is needed, generators are dispatched on an economic basis, subject to reliability constraints and congestion. In some markets, the economic dispatch of the demand-side resources is growing significantly, altering the economics for conventional generators.

Increased penetration of variable renewable energy sources affects the energy markets in three ways, namely:

- There is an increase in the frequency and magnitude of changes to net load. This in turn requires that the system is provided with the capability for fast ramping and frequent on-off cycling
- The higher possibility of forecast errors increases the difficulty in anticipating market outcomes, thereby increasing the relevance of real-time markets
- The proportion of the fully dispatchable supply (dispatchable generation are those generation technologies that can be dispatched by the off-taker, e.g. the thermal facilities and the big hydro generators) could decrease as the low marginal costs of the renewable energy displace them from the market, with the attendant economic problem for the conventional generating plants

6.5.2. Capacity Market

Capacity markets are motivated by the desire to employ a market mechanism to ensure that new generation capacity is developed on time to meet resource adequacy targets and to ensure that resources that are required for long-term reliability can recover their total costs of building and operating the large generating facilities. Power plants are large, capital-intensive resources that take considerable time to permit and build. The decision to build a power plant must be made well before the plant is needed.

6.5.3. Ancillary Services (Operating Services) Market

Ancillary Services, as defined by the Federal Energy Regulatory Commission (FERC) and the North American Reliability Corporation (NERC) are “those services necessary to support the transmission of

capacity and energy from resources to loads, while maintain reliable operation of the Transmission Service Provider's transmission system in accordance with good utility practice"[10]. In other words, the Ancillary Services are a collection of services which are necessary to maintain a balance between supply and demand and ensure voltage and frequency support to the power system.

The ancillary services are used to support power system reliability and they perform necessary services that the market cannot provide. To support trading of energy in the power system, all transmission providers in the market are required to procure ancillary services to support grid stability and supply reliability. These services are common components of every market design.

Ancillary Services market typically includes Spinning, Non-spinning and Regulation Reserve Services. Other Ancillary Services such as Reactive Power supply for voltage control and Black Start facilities for restarting the system in the event of partial or total collapse, are serviced through cost-based mechanisms and do not have markets. The ancillary services prices are determined on the basis of lost opportunity cost. The lost opportunity cost is the revenue that a resource can forego in a separate market in order to provide capacity for the ancillary service.

Generation from the Renewable Energy Sources are noted for their variability and uncertainty. Generally, ancillary services are used to better manage variability and uncertainty in the power system. When system variability and uncertainty are increased with increasing penetration of renewable energy sources (RES), more operating reserves may be needed. Variable renewable energy (VRE) can affect the design of Ancillary Services market in the following ways:

- The variability and uncertainty of wind and solar energy generation increases the requirements for various ancillary services, affecting the scheduling and pricing of these services
- The impacts of the VRE vary depending on the system conditions, and this make the ancillary services demands difficult to generalize across the timescale and systems
- Allowing VRE to participate in the ancillary services markets can offer more supply to the market, but can also create challenges based on the unique characteristics of variable energy resources

The aggregate impact of significant variable renewable energy on the grid suggests the need for modifications to the current ancillary services market designs and rules.

Voltage Control

Reactive power, which supports voltage control, does not travel far due to high inductive impedances. It is therefore very localized. In general, all generators, except the wind plants are required to be capable of providing reactive power within a power factor range defined in the connection Agreement. Generators are paid for any costs they forego in the energy markets because of their use in the provision of reactive power, instead. The Transmission Service Providers are also required to have reactive power capability at strategic transmission stations or substations, to inject or extract reactive power for voltage control.

[10] Market Evolution: Wholesale Electricity Market Design for 21st Century Power System, the National Renewable Energy Laboratory, USA, 2013.

6.6. Market Rule

The wholesale electricity market is governed by the wholesale electricity market rules which details the roles and functions of the market governance participants and guide the operation of the market including the wholesale purchase and sale of electricity, provision of reserve capacity, and ancillary services. Some of the objectives of the wholesale electricity market rules, as shown from the review of the other regional market designs, are:

- to promote the economically efficient, safe and reliable production and supply of electricity and electricity related services in the interconnected system;
- to encourage competition among generators and retailers in the interconnected system, including by facilitating efficient entry of new competitors;
- to discourage discrimination in the market against particular energy options and technologies, including technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions;
- to promote the minimisation of the long-term cost of electricity supplied to customers from the interconnected system; and
- to encourage the taking of measures to manage the amount of electricity used and when it is used

6.6.1. Subservient Documents

The WEM Procedures, any other document or instrument issued, made or given by the Regulatory Authority, a Network Operator or a Market Service Provider under the WEM Rules are subservient to the WEM Rules.

In the event of conflict between the WEM Rules and other documents, the order of precedence is to be as follows :

- the Electricity Industry Act;
- the Regulations;
- the WEM Rules;
- the WEM Procedures;
- any other document or instrument issued, made or given by the Regulatory Authority under these WEM Rules; and
- any other document or instrument issued, made or given by the Market Service provider under these WEM Rules.

If a provision of a document which is higher in the order of precedence (i.e. higher provision) is inconsistent with a provision of a document which is lower in the order of precedence, then the higher provision prevails, but only to the extent of the inconsistency.

In fulfilment of the above objectives, some other key provisions of the Market Rules applicable to every electricity market are:

- Provisions on Dispute Resolution
- Provisions on Monitoring, Enforcement and Audit
- Provisions on Registration and Participation in the market
- Provisions on Prudential Requirements for participation in the market
- Provisions on transmission and distribution Loss Factors

- Provisions on Communication and system Requirements
- Provisions on Market Settlements
- Provisions on Balancing Market
- Provisions on Wholesale Market Metering
- Provisions on Market Invoicing and Payments
- Provisions on Market Information

6.6.2. Market Governance

Under the Governance Rules, the Market Rules assign responsibilities to the Market Governance Participants (MGP) in the wholesale Electricity Market. The MGPs and some of the roles assigned to them are as follows:

6.6.2.1. Market Operator

The Market Operator (MO) is conferred functions in respect of the Wholesale Electricity Market under the WEM Regulations. Such functions include the day-to-day administration of the market to ensure transparency, non-discrimination and efficient operation of the market.

Some of the specific functions assigned the MO include:

- to settle such transactions as it is required to under the WEM Rules;
- to process applications for participation, and for the registration of participants as well as carry out participants' de-registration;
- to establish, maintain and update the participants' Register from time to time;
- to release information required to be released by the WEM Rules;
- to publish information required to be published by the WEM Rules;
- to develop WEM Procedures, and amendments and replacements for them where required by the WEM Rules subject to the approval of the Regulatory Authority;
- to make available copies of the WEM Procedures, as are in force at the time;
- to monitor Participants' compliance with WEM Rules and WEM Procedures;
- to support the Regulatory Authority in its roles of monitoring market effectiveness, including providing any market related information required by the Regulatory Authority;
- to contribute to the improvement of the effectiveness of the operation and administration of the Wholesale Electricity Market, by developing Rule Change Proposals, as well as providing support and assistance to other parties to develop Rule Change Proposals;
- to carry out any other functions conferred, and perform any obligations imposed on it under the WEM Rules.

The MO may delegate any of its functions under the WEM Rules to a delegate. A function performed by a delegate is to be taken to be performed by the MO, and for the purpose of this, a delegate is a "Market Governance Participant" and the MO remains liable under the WEM Rules for the performance of any function delegated to the Delegate.

6.6.2.2. Regulatory Authority

The following functions are the responsibilities of the Regulatory Authority under the WEM Rules:

- to set standards and approve tariffs, monitor and enforce compliance with the standards and tariffs, to ensure efficient operation of the electricity market;

- to monitor the Participants' compliance with the WEM Rules, to investigate potential breaches of the Rules, and if thought appropriate, initiate enforcement action under the regulations and the WEM Rules;
- to issue licenses to the participants in the electricity market, and regulate the purchase and procurement of electricity by the distribution companies and the load-serving entities;
- to resolve dispute involving participants in the market, including market service providers;
- to promote the generation of electricity through the renewable energy sources;
- to contribute to the development and improve the effectiveness of the operation and administration of the Wholesale Electricity Market and the WEM Rules, by approving rule change proposals;
- to carry out any other functions assigned, and perform any obligations imposed, on it under the WEM Rules.

6.6.2.3. Network Operators

These are the entities that operate and maintain the transmission and distribution systems of the electricity industry. Electricity gets to the consumers through the transmission network, which conveys power from the generating plants to the load centres, and the distribution network, which conveys the electricity from the load centres to the consumers' homes and businesses. The functions assigned to the network operators include:

- to calculate and provide the transmission and distribution loss factors to the Market Operator;
- to perform the functions in relation to the standards or technical level of performance in respect to the transmission and distribution network that the Network Operator operates;
- to do anything that the Network Operator determines to be necessary and relevant for the efficient performance of the functions of the Network Operator;
- to carry out any other functions assigned to the Network Operators under the WEM Rules

6.6.2.4. Market Advisory Committee

This is a committee of Industry Representatives, set up by the Regulatory Authority to:

- advise the Regulatory Authority regarding Rule Change Proposals;
- advise the Market Operator, System Operator, the Regulatory Authority and the Network Operators regarding Procedure Change Proposals;
- advise the Regulatory Authority regarding matters concerning the evolution and development of the Wholesale Electricity Market and the WEM Rules; and
- provide assistance to the Regulatory Authority in its monitoring role under the WEM Rules

The Regulatory Authority should develop and publish guidelines for the Market Advisory Committee (MAC) detailing its terms of reference, process of convening and conducting its meetings, as well as its interactions with other Market Governance Participants. The Guidelines, which must be consistent with the Market Rules, should highlights the MAC's ability to delegate any of its roles to a Working Group.

6.6.3. Market Surveillance

Market Surveillance is a critical part of Market Governance. It is a basic function in the deregulated electricity market and involves the supervisory actions of the Regulatory Authorities, the Market and

System Operators to ensure the efficient performance of the market. Market Surveillance is therefore a standard component of electricity market design. The main Market Surveillance activities include:

- detection of attempts to exercise market power and fraudulent behaviour;
- monitoring of market performance to enable control of market development
- identification of market design imperfections;
- monitoring of the behaviours of the market participants (activities and transactions)
- controlling of transmission and generation blackouts;
- investigations of possible violations of the Regulations, Rules and Procedures of the electricity market;
- enforcement of compliance, with the primary goal to achieve compliance and not necessarily to impose penalties.

Market Surveillance is more of the monitoring of economic parameters of the electricity market than the technical parameters. Monitoring of the technical parameters is important to the extent of its roles in the monitoring of market power, market performance and participants' behaviours, which have economic outcomes. Market Surveillance goes beyond market monitoring to include the actions introduced to protect the market from unnecessary market influences.

7. Comparative Analysis of ECOWAS Regional Electricity Market Design with the Market Designs of the Developed Regions

The review of the markets from the developed regions of the world has highlighted a number of lessons, which have resulted in the identification of the challenges to the design of ECOWAS Regional Electricity Market, as well as in making some recommendations for the enhancement of the ECOWAS REM design. These lessons, challenges and recommendations are presented in the sections below. Also, the table below has been presented to show the comparison between the design characteristics of ECOWAS electricity market and those of the markets for the developed regions.

7.1. Comparison between the Design Characteristics

Characteristics	ECOWAS REM	Electricity Market for Developed countries
Design objectives	• Providing the conditions for short-term supply reliability • Providing the conditions for long-term investments for security of supply • Ensuring active participation of customers in the electricity industry • Fostering decentralization of the operations of the electricity industry and supporting market efficiency	• Promoting efficient operation of the power system • Creating clear and effective incentives for investments in the power system • Improving reliability and cost-effectiveness of electricity service • Reducing the health and environmental impacts of electricity service • Rapidly expanding energy access to unserved and under-served customers • Encouraging innovations in the power systems

Design Principles	• Gradualism: market should develop gradually and progressively • Transparency and Non-discrimination: Trading rules and operation of the REM should be based on the principles of transparency and non-discrimination • Competitiveness: REM should be based on participants' freedom to trade competitively • Promotion of generation expansion: There should be appropriate conditions for the development of generation capacity • Respect for national Regulations: REM should be designed with little or no modification of the domestic regulations • Facilitation of Infrastructure Expansion: Trading platform should facilitate expansion of transmission infrastructure • Rules easy to understand and implement: For the market to succeed, the trading rules should be clear, transparent, easy to understand and apply • Access to Transmission Infrastructure: There must be open access to transmission facilities • Converging Standards: Countries should converge to common standards for seamless trading across the borders	• Promoting short-term market efficiency: Market design should encourage wholesale competition while preserving system reliability • Enabling demand-side participation: Market design should ensure strong participation of the demand side of the market • Providing open access: Open access to the grid system is an essential element of introducing competition to electricity markets and of increasing their efficiency • Ensuring supply adequacy: framework for long-term supply adequacy should be ensured to meet demand without experiencing supply constraints
Market Structure	• Mostly vertically integrated, government owned and operated • Generation capacity is limited, with limited technologies in the mix. There are no nuclear, coal and limited RES at the moment • Generators are part of the vertical integration, investments are subject to decisions of the government • Wholesale market yet to be operationalized in most of the countries, due to size of the market and limited transmission infrastructure • No effort to regulate the sizes of each generators. There is no competition • The emerging technologies are absent at the moment, but will be incorporated into the design update • Transmission is a critical element of the market structure, with limited scope and size • There are no RES initiated transmission infrastructure development. This will be incorporated in the ultimate design for the REM	• Substantially restructured, with the generators unbundled from the utility to compete to serve loads • Generation capacity is considerable, with many technologies in the mix, including nuclear, renewable energy sources, coal, etc • Generators operate in a competitive market, make investment decisions, gain or lose based on such decisions • Wholesale markets in operation, with adequate generation capacity and robust transmission infrastructure • Effort is made to limit the size of each generation plant to avoid issues of market power • Emerging technologies in the WEM structure include: Demand-side response, Distributed generation and Distributed energy storage facilities • Transmission is a critical element of the market structure, the scope and size

		are more because of the status of the market • With the growing penetration of RES in these markets, transmission infrastructure development is attracting a lot of attention
Market Architecture	• Energy market consists only of the Forward Market. The DAM and RTM are in the design, but yet to be operationalized • Capacity Market is not developed • Ancillary Services Market is not fully developed due to limitation in generation capacity and transmission infrastructure	• Full complements of the Energy Market is in operation • Capacity Market is fully developed • Ancillary Services Market is fully developed, with all the complements for frequency and voltage control, and the Black Start facilities for starting the grid
Market Rules	• This is the encapsulation all of the market design characteristics. • Scope of the Market Rules is limited by the level of market development. • Market rules includes the roles assigned to the Market Governance Participants (MGP). • Included in the MGPs are the Regulatory Authority, Market Operator, System Operator and Network Operators	• This is the encapsulation all of the market design characteristics. • Due to the status of the electricity market in these developed countries, the Rules are expanded. • Apart from the roles of the Regulatory Authority, Market Operator, System Operator, and Network Operators, Market Rules includes the roles assigned to the Market Advisory Committee (MAC). • Expectedly, due to the status of the markets in the developed regions, the provisions of the Market Rules in the developed regions are more sophisticated than the ECOWAS Regional Market Rules

7.2. Complexities of the Electricity Market

Review of the international examples of market design highlighted some complexities of the electricity market, which are taken care of in any good design. Fundamentally, electricity markets are complex in the way they combine the physics of electricity supply with the principles of economics.

The most basic complexity in the electricity market is the real-time balance of supply and demand. This is necessary because of the inability to effectively store electricity. Supply shocks can be especially large and unpredictable as a result of the failure of a large generating unit or a strategic transmission line. This situation requires that the System Operator has a significant quantity of flexible resources that are quickly able to ramp up or down in response to contingencies. Properly rewarding these flexible reserve resources is a major challenge of the market design.

Another important complexity of the electricity market is the near vertical demand curve. That is there is little demand response to prices. This means that the market is potentially vulnerable to the exercise

of market power on the supply side, and that the demand side is unable to protect itself by curtailing demand in response to high prices. Moreover, this problem gets worse as the market approaches real-time, due to the limited options.

The next source of complexity is the network constraint, especially where generation resources or load demand are concentrated. There will be the incentive to exercise market power on the supply side where network constraints prevent generation access to a concentration of demands. Conversely, there will be incentive to exercise market power on the demand side where network constraints prevent consumers' access to supply.

7.3. Key Lessons from the Review of other Regional Electricity Market Designs

This study has compared the ECOWAS Regional Electricity Market Design with the designs of some other Regional Markets, typically, American, European, Australian and Southern African Regional Markets. The study reveals some lessons necessary for the ECOWAS Regional Market Design. This part of the Report highlights some of these lessons as follows:

a. Regional electricity market should progress from a small number of countries, towards increasingly competitive wholesale arrangement involving a larger number of countries, guided by clear time-bound roadmap. In terms of market architecture, the regional electricity market should evolve from the initial long-term bilateral contracts, towards the use of day-ahead market and real-time markets, which facilitate more trade and greater market efficiency.

b. Electricity markets should be carefully designed to reduce the scope of market power abuse, as well as to ensure minimal design flaws. The design should be such that competition is introduced gradually in the wholesale power trade in the developing countries, given the general absence of the necessary conditions for open competitions in power markets. This can be achieved in steps, as follows:
    - Distribute generation capacity fairly among many Generator Owners to avoid the situations where any generator can exercise market power
    - Provide regulated open access to the transmission network to third parties, allowing multi-buyer trading on bilateral basis between Generators and Load-Serving Entities (LSE)
    - Structure the System Operator to represent the interest of all wholesale market participants, without being under undue influence of any group of participants when dispatching system supply capacity
    - Ensure that the LSEs pay generators fully and promptly, and in turn, that Generators pay the fuel suppliers fully and promptly

c. An important lesson from developed countries around the world is that initial market design will inevitably have flaws. This implies the need for ongoing market monitoring to correct these flaws before they develop into serious problems, and the need for a credible regulatory process that:
    - Sets well-defined boundaries on acceptable market outcomes
    - Defines those outcomes that justify regulatory intervention

- Clarifies in advance the form of any legitimate regulatory intervention and follows through with these pre-commitments, should the standards for acceptable market outcome be violated

d. Market monitoring and regulatory oversight are important for successful power market development. Market monitoring is intended to detect and verify abuse of market power, correct design flaws and prevent further abuses. However, devising theoretically sound and practically useful market monitoring procedures is a challenging task in the development of electricity markets. Therefore, care must be taken to design regulatory mechanisms that do not further exacerbate market challenges. This is to ensure that the situation where the cure for a disease is not worse than the disease, since excessive regulatory mechanisms can introduce more economic harm than the market power they are attempting to prevent. The regulator must design proactive protocols for rapid regulatory intervention to correct design flaws as quickly as possible, including ordering refunds as soon as unjust and unreasonable prices are found.

e. Forward bilateral transactions should be the central transactions in the market, accounting for vast majority of the volume. These trades should be supported by day-ahead and real-time markets for energy and reserves.

   Forward contracts play an important role in mitigating the incentives to exercise market power. A supplier that sold 100% of its generation in the forward market has no incentive to manipulate the spot price. In this case, both the Sellers and the Buyers have an interest in forward contracts, since the contracts reduce the risks of both parties. The forward contracts are financial contracts that enable parties to lock in acceptable prices. A supplier may decide to satisfy its load obligation through spot purchases, whenever the spot price is below the supplier's cost. Ideally, the spot price is used to price deviations from positions taken in forward markets. Less is riding on the spot price and so the incentive to manipulate is greatly reduced.

f. The market should be run by Service Providers, that are independent of any stakeholder. It is therefore important that the Independent SMO is established for the REM as soon as possible.

g. Means for market power mitigation and monitoring must be included in the rules for operating the market. Stable and consistent market rules will encourage investments and promote efficient trade across market boundaries.

h. Transmission planning is a central activity of the independent service providers. Transmission expansions are paid for by those that benefit from the specific transmission infrastructure. Access to the grid must be rationed by price and on a non-discriminatory basis.

i. Demand response must be recognized as critical to both reliability and mitigation of market power. Demand response is essential in avoiding market failures in situations of inadequate generation. Demand response is a form of reserves, providing the flexibility that the SO needs to balance supply and demand in real time. Demand response is put on equal footing with supply and transmission expansion plans. Due to demand response, there is less demand when prices increase, thereby releasing capacity to enhance reliability even in the face of generation limitation. Also, reliability is enhanced by transmission expansion plans as these will ease transmission congestion, improve power quality, and facilitate transmission access.

Good market design is crucial to the success of electricity markets. The greatest motivation for restructuring of the electricity industry is the recognition that there are potentially large gains in both

efficiency and reliability from expanding the geographic scope of electricity markets. These gains are lost to the extent that incompatible market designs prevent trades across the national markets.

Good market design begins with a thorough understanding of the Market Participants, their incentives and economic problems that the market intends to solve. In designing the Regional Electricity Market, these key elements should be considered. The Market design should be informed by the past successes and failures of actual markets around the world. Ideally, the design will include all the key ingredients of success and avoid the flaws that have led to market failures, as observed from the reviews.

Good market design also begins with the key design objective, which is the efficient and reliable production of electricity to satisfy demand, including short-run reliability and long-run efficient investment decisions. Also, good market designs should not lead to market inefficiency, exercise of market power, reduced competition or reliability degradation. Good market designs must not only ensure resource adequacy, but revenue sufficiency also. When adequate resources are acquired, they must have the opportunity to earn sufficient revenue to remain in the market. Without revenue sufficiency to recover both the fixed and variable costs, it is likely that resources would retire from the market, potentially compromising long-term reliability.

The cases of the California market failure and the success of the Massachusetts market are typical examples of how market design can promote market failure or successful market. In the case of Massachusetts, when the cost of supplying load was greater than the regulated rates, the utilities would be compensated for actual costs through charges that would be added to consumer bills over a period of time. In the case of California, the utilities retail revenues were fixed at the regulated rates. They did not receive any compensation in the event wholesale prices exceeded the regulated rates. This, together with the fact that utilities were not allowed to purchase power in forward contracts, meant that they were exposed to enormous price risks.

It is expected that the most obvious flaws would be identified and eliminated before the market is implemented, but unfortunately, this is not always the case. There are examples of basic market flaws which not only survived the design process, but also endured for an extended period after the flaws are identified. Typically, some group of market participants benefit from the flaws, and if the group is large enough, it can block moves to correct the problem.

8. Challenges to the Design of ECOWAS Regional Electricity Market

A good market design should ensure the absence of any incentives for the exercise of market power and other unwholesome behaviors in the electricity market. However, the electricity market naturally exhibits some complexities, which constitute challenges to the design of ECOWAS Regional Electricity Market. Some of these challenges, which the ECOWAS REM must address to mitigate some of the flaws in its design include:

a. Both the transmission grid and the generation resources of each of the member states have physical limits, which will challenge development of wholesale REM
b. There is significant uncertainty in both supply and demand, and these need to be balanced at all times

c. Availability of adequate reserve resources to maintain real-time balance of supply and demand, and availability of appropriate incentives to encourage the provision of such flexible resources
d. Variability and uncertainty are the characteristics of electricity. With the increasing interest and penetration of renewable energy generation in the electricity market, the challenges of variability and uncertainty will become more pronounced in the electricity market. Therefore, the national System Operators and the Regional SMO will have to be prepared to grapple with these additional challenges as more RES are deployed in the system
e. The fact that consumers are insulated from the actual time-sensitive prices of electricity is a flaw and a major challenge. (customers cannot respond to both the wholesale and retail prices of electricity)
f. Consumers cannot choose the level of their individual electric reliability. In this case, it is usually not technically or economically possible to differentiate levels of reliability to consumers (especially residential consumers) who may be willing to pay more for reliable service, or conversely, customers who may be willing to receive a lower level of reliability in return for lower prices. This, again is a demand-side flaw and a major challenge in the design of electricity market
g. An important challenge to market design is revenue sufficiency for long-term reliability. This has to do with tariffs and energy loss management
h. The level of development of national markets and the limited regulatory capacity of national regulatory authorities in the region, means that there are very limited regulations for regulating the markets. The requirement that the REM should be designed with little or no modification of the domestic regulations is not considered very relevant for the ECOWAS REM especially where basic harmonization of national regulatory frameworks are required for the optimal performance of the REM
i. Convergence in the general principles of market design and their applications to the existing national markets. This convergence will foster the implementation of cross-border trading among the ECOWAS member states
j. The characteristics of renewable energy generation (especially the Variable Generation sources – wind speed and solar irradiance) create unique challenges in the planning and operation of the power system, as well as in the design of the electricity market. These variable generation sources have zero variable costs, because of free source of fuel, and this can influence the outcome and performance of the electricity market.
k. Given that the renewable generation is variable and intermittent, and nuclear generation is highly inflexible, the conventional generators need to remain synchronized in the system and operated part-loaded as a back-up energy source and flexibility provider. The under-utilization of the conventional generators implies that cost efficiency of their operation will reduce, this will be aggravated by the increased start-up and short down cycles, driven by the system variability and power ramping requirements.

9. Recommendations for the Enhancement of the ECOWAS Regional Electricity Market Design

In many respects, the design of the ECOWAS Regional Electricity Market is consistent, in the objectives and principles, with the best practice standards in electricity market designs. There are differences in market structure, trading arrangement and market rules, but these are mainly as a result of the differences in levels of development and sophistication of the regional markets. As the ECOWAS electricity network expands and the market develops, the design will be reviewed and most of these differences will be eliminated. However, given the identified gaps in and the challenges to the ECOWAS Regional Electricity Market Design, the recommendations below, which are consistent with the Market Design for good industry practice and evolving power systems, have been proposed for the enhancement of the ECOWAS Regional Market Design:

9.1. Recommendations on Overall Market Design

a. The Regional Electricity Market design has made provisions for the conditions for short-term market efficiency, as well as the conditions for long-term investments in the market. These conditions should be reviewed to ensure their applicability, since these are the critical objectives of electricity market design.

b. The structure of the market must be as simple as possible and built around the customers. The structure should support today's market, as well as the future market.

c. The Market Design for the region should take into consideration the variability of electricity consumption and the intermittent production from the renewable energy sources (RES). This is in consideration of the growing importance and increasing contribution of RES in the global generation mix. The market should be flexible enough to face the challenges of increasing levels of RES.

d. Like in other regional markets, the goals of the ECOWAS Regional Market should be framed within long-term views and reviewed from time to time, in the light of changes and actual experiences arising from the current reality of the regional power market on its way to maturity. This is in line with the principle of gradualism, which the ECOWAS Regional Electricity Market is based on.

e. There is need to consider the increasing interest in the national electricity market where consumers are also producers of electricity (ie Prosumers), in the design of REM.

f. The Market design should, above all, ensure secure, sustainable, affordable and competitive electricity supply for all customers.

g. Electricity Markets are extremely complex and prone to problems, it is therefore recommended that the design of the market at any phase should undergo at least a minimal testing (bottom-line test) before implementation. Untested designs have caused real-world market failures. Suppliers are quick to take advantage of design flaws, especially those that pay high for products that are worth less. A moderately rigorous test would involve a simulation of the market design. In testing the market, we test for the Structure, Architecture and the Rules.

h. There is need for clear and transparent institutional and legal framework, both at the regional and national levels, upon which the regional electricity market design will be based.

i. Scarcity of electricity supply is a national problem, but over-capacities would occur if this national problem is solved nationally. Regional coordination is therefore recommended in the provision of solution to the question of scarcity of supply at the national level.

j. Improvements in the scope of cross-border connections: Interconnectors to other systems, which enable large-scale sharing of energy, ancillary services and back-up resources should be promoted.

k. The regional electricity market design, as well as the reviews of such design, should be largely the work of experts focused solely on the objectives of the market to produce design that will eliminate as many flaws as possible and encourage trade across the borders.

l. A minimum level of harmonization of regulatory frameworks should be encouraged given the level of development of the national markets as well as the limited capacity of NRAs. This may entail the change of national electricity policies and regulations and will have to be done for the proper functioning of the REM and the streamlined development of the market.

9.2. Recommendations on Impacts of Renewable Energy

Generation of electricity from renewable sources such as wind and solar is the future of the power system globally, but these energy sources are noted for wide range variability and unpredictability, especially when implemented in large scale. Given these tech – economic challenges associated with the penetration of renewable energy sources (RES) in the electricity system, the following recommendations are necessary to achieve a stable energy system at reasonable level of penetration, and reduce the curtailment of renewable generation and the efficiency losses of the conventional generation, as well as limit peak demand levels and therefore avoid capital intensive investments in under-utilized generation and network assets.

a. Implementation of demand side responses (DSR): DSR schemes can redistribute electricity consumption across time without significantly compromising the service quality delivered to customers.

b. Implementation of Energy Storage facilities: Energy storage technologies have the ability to act as both demand and generation sources, and flexibly schedule their input/output across multiple time scales.

c. Investments in Flexible Generation: Advances in conventional generation technologies are allowing them to provide enhanced flexibility to the system. This is due to their ability to start more quickly, operate at lower levels of power output (minimum stable generation), and achieve faster changes in output to maintain the system frequency within its statutory limits. This way, the need for synchronized conventional generation plants, with the associated costs to take care of instability of the RES will be less.

d. Introduction of price taking Distribution Side Response (DSR) and Energy Storage (ES) to limit and smoothen the peak demand, as well as to supply the system during periods of limited

cheap generation (particularly in the nights when the solar generating plants are out of service.

9.3. Recommendations on Market Structure, Architecture and Market Rules

a. From the perspective of the Market Structure, the design should ensure that the conditions for the exercise of market power are not promoted. Such conditions include the existence of market participants that are large enough to influence prices to their own advantages. The system structure of the market and the participants' financing structure should promote reliability and affordability of power supply.
b. A major problem of the electricity markets is that inadequate attention is paid to the implication of market power. In all markets, the absence of demand response has contributed enormously to the vulnerability of the market to the exercise of market power. It is therefore essential that at least some electricity consumers have the ability to see and respond to the real-time prices of electricity in the region.
c. Market Power has been shown to be a major market abuse through the strategic behaviour of the generating companies in the electricity market. Some of the measures to mitigate this abuse include the following:
    - Promoting the separation of dominant companies in order to limit the market share of each company. In this case, a company with say six huge generating units can be split into three companies with two units each
    - Encouraging the entry of new participants in order to foster competition
    - Imposing price caps and floors on participants
d. From the perspective of the Market Architecture, the design should specify the types of sub-markets to be operated in the market, the applicable trading arrangement, for a sustainable and efficient market operation.
e. From the perspective of the Market Rules, the design should make provisions for all the sub-markets, trading arrangement as well as all the good market behaviours and the relationships applicable in the market. The Market Rules should provide for the monitoring of the participants' compliance with the provisions, as well as compliance enforcement. Given the fact that there must be some issues that were not considered when the rules are developed, there must be provisions for amending the Rules whenever the need arises.
f. From the point of view of good utility practice, the key objective of the electricity market is the provision of reliable electricity at the least cost to the consumers. Therefore, the market should be designed, along the design characteristics (ie the market structure, architecture and the rules), in such a way as to ensure that the above objective is achieved.

10. Operational Functions of the ECOWAS Regional Electricity Market and Associated Indicators

The Operational Activities of the REM are those critical Functions that have direct impacts on the reliability of the WAPP Interconnected Power System, as well as on the development and efficient functioning of the Regional Electricity Market. Fundamentally, the Activities are groups of tasks required for maintaining power system reliability and efficient operation of the electricity market. The

Associated Indicators are the procedures for performing the Functions (for the regional electricity market preparation stage) and the market outcomes in the form of data (for the market operation/implementation stage). That is, the availability of these procedures is an indication that the Functions will be implemented. These indicators for Market Preparation deal with the broader aspects or the macro issues of market surveillance, which are mostly monitored by observation. On the other hand, indicators for **Electricity Market Implementation** are the market data (eg numbers, values or levels of something compared with something else) for the evaluation of the performance of a market participant or the electricity market, ie outcomes of market implementation. The indicators for Electricity Market Implementation are concerned with the micro or specific issues of market surveillance, which are monitored through data gathering, validation and analysis.

Operational Functions of the electricity market can be divided into two categories, namely the Technical (or Physical) and the Commercial (or Merchant) Functions. The Technical Functions of the electricity market are embedded in: Generation, Transmission, System Operations, and Distribution functions, and are mainly responsible for the reliability and technical stability of the Regional Power System. These activities include the operating and planning – related activities.

The Commercial Functions are embedded in wholesale market operations (consisting of the bilateral, day-ahead, real-time, and ancillary services markets), and the Retail market operations. These Functions are responsible for the development, commercial stability and efficient functioning of the Regional Electricity Market.

The following narratives describe the Market Functions identified in the Regional Market Documents. The narratives also show the relationships between the Market Functions and the associated Indicators, as well as the Benchmarks, upon which the Regional Electricity Market Surveillance are based. Market Surveillance involves monitoring of both the behaviour of Market Participants and the Regional Market Institutions, to ensure compliance with the regulations, as well as with the technical and commercial provisions of the Market Documents. It involves the regular evaluation and assessment of the Market Outcomes, as well as the Market Documents for adequacy and efficiency of the Regional Electricity Market. Market Surveillance also involves the regular assessment of the market design to detect any flaws that may result in significant inefficiency or market failure. The Market Documents may be reviewed as necessary to ensure relevance and adequacy.

10.1. Technical Function

As indicated above, the Technical Function are those that have bearing with the reliability of the regional power system and are referred to as the Power System Reliability (PSR) Function. These Functions are as follows:

10.1.1. Function PSR-1: Drafting and Approving of WAPP Operation Manual (Regulation C/REG.27/12/07, Section e.18)

The objective of the WAPP Operational Manual is to ensure that all the interconnected power systems of the West African Power Pool (WAPP) operate the interconnected network efficiently and effectively and that they participate equitably in the obligations and in the benefits resulting from the Interconnection. The Manual is designed to ensure co-ordinated operation between interconnected power systems and to achieve high levels of system reliability and control at the points of

interconnection. The Manual which is based on established technical and operational experience accumulated over the years, specifies how the operational guidelines of WAPP shall be implemented.

All interconnected utilities in WAPP should comply with the contents of this document. Just like in the case of the Regional Market Rules, it can also be used as a basis to prepare more detailed documents (*e.g*. Operational procedures) governing the operation of each individual network. The WAPP Operation Manual will enable all the interconnected Power Systems to monitor the operations of the West Africa Grid and to compare them against a benchmark. This document should be reviewed as the need arises.

Some of the tasks involved in the drafting of the WAPP Operation Manual are:

- Set out the standards to be complied with by every user of the Regional network
- Provide procedures for monitoring compliance with the standards
- Provide procedures for carrying out Operational Planning of the interconnections

The Indicator for this Function is **Compliance with the Market Design Provisions**, which specifies the objectives, the principles and methodology for developing the Operation Manual. Compliance with the Market Design Provisions in the development of the WAPP Operation Manual is determined from observations, while the Benchmark associated with this Function is the availability of the Manual.

10.1.2. Function PSR-2: Operational Planning of Interconnectors (WAPP OM, P4)

Operational Planning of the Interconnectors involves the assessment of the reliability of the Interconnectors. This means evaluating the ability of the Interconnectors to supply power and energy demand at all delivery points at any time within acceptable standards. Interconnector reliability can be defined by two basic and functional attributes, namely adequacy and security.

Adequacy is a measure of the capacity of an Interconnector to supply the aggregate electric power and energy demand of customers, taking into account, planned and unforeseen outages of system components. **Security** is a measure of the ability of the Interconnector to withstand sudden disturbances such as electric short circuits or unforeseen loss of system components.

Assessment of the reliability of the Interconnectors involves evaluating whether the transmission system is sufficiently sized to accommodate the potential imports and exports resulting from the various cross-border interchanges. At the WAPP level, the transmission system adequacy analysis focuses on the interconnections and on the internal lines, which have a direct effect on the international exchanges.

Based on the outcome of the reliability assessment, areas of network weaknesses will be identified, and generation and load dispatch operations will be guided.

Some of the tasks involved in the Operational Planning of Interconnectors are:

- Evaluating the ability of the power system to supply power and energy at the delivery points at any time within acceptable standards
- Conducting generation adequacy for the region to establish a power balance forecast
- Conducting transmission system adequacy for the WAPP interconnected system

- Conducting system analysis to assess the reliability of the interconnected system and determine the investments needs

The Indicator for this Function is Compliance with the approved Procedures for Operational Planning of the Interconnectors, which explain the principles and methodologies for operational planning of the Interconnectors in the regional electricity market. Compliance with the procedures is determined from (or monitored) with observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.1.3. Function PSR-3: Addressing issues of Force Majeure Events (FME) in the Electricity Market (RMR, Art.11)

A Force Majeure Event is an unforeseeable event beyond the reasonable control of market participants, which prevents any one of the parties from performing its obligations under the bilateral contracts, RMR or Operation Manual. In the event of a Force Majeure event, the terms and conditions of the Market Rules are suspended, and no financial penalty is attached to any party for failure to discharge obligations as a consequence of the Force Majeure event.

The TSOs of the country or countries within whose boundaries the Force Majeure event occurs should use all reasonable endeavours to mitigate the consequences of the event on the regional transmission system in accordance with the procedures for addressing Force Majeure Events, as well as prudent utility practices.

The process of reporting the Events, declaring the Events and the actions taken to mitigate their impacts (and restore reliability in the affected areas), is important for the growth and efficient functioning of the Regional Electricity Market. ERERA has the responsibility for declaring an event as a Force Majeure Event.

Some of the tasks involved in addressing issues of Force Majeure are:

- SMO to be promptly informed by the party affected by the FME of the impossibility to meet obligations
- Suspension of the terms and conditions of the RMR
- SMO to inform all Market Participants of the Event
- SMO verifies the scope of the FME and informs all unaffected participants to continue with trades
- TSOs of the relevant countries to mitigate the consequences of the Event on the regional transmission network

The Indicator for this Function is **Compliance with the approved Procedures for addressing issues of Force Majeure**, which specifies the modalities for dealing with such issues in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.1.4. Function PSR-4: Interconnector Scheduling (WAPP OM, P3.3)

Interconnector Scheduling involves the determination of the maximum capacity on tie-lines between Control Areas, Scheduling and implementing interchange between Control Areas and Real-time monitoring of cross-border power flows between Control Areas.

The net amount of Interchange Schedule between Control Areas should not exceed the mutually agreed transfer limits of the interconnector. The entire network, including the tie-lines should be operated in such a way that sufficient capacity is available for delivering power, including the reserve power for system balancing.

Some of the tasks involved in Interconnector Scheduling are:

- Determination of transmission capacity between Control Areas based on reliability criteria in order to ensure security of the WAPP Grid
- Communicating the transmission capacity to the ICC
- Assessing and publishing of the capacity on the WAPP website by the ICC
- Scheduling and implementing interchange between Control Areas
- Real-time monitoring of the cross-border power flow between Control Areas

The Indicator for the Function of Interconnector Scheduling is **Compliance with the approved Procedures for Interconnector Scheduling**, which specifies the steps and modalities for Interconnector Scheduling in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.1.5. Function PRS-5: Congestion Management (WAPP OM, P2.2.5)

Congestion is a situation in which the capacity of an interconnection between Control Areas is insufficient to accommodate all scheduled interchanges. A congestion exists if the operation (N-1) criterion cannot be satisfied as a result of the load flow on the network under consideration.

If in the opinion of any party, the scheduled transfer may jeopardize the security of supply to its system, this party has the right to request the other to reduce its import or export to an amount that will be specified by the Control Area concerned. The party so requested should comply promptly.

The N-1 criterion can be defined as any probable single event leading to a loss of any power system element that shall not endanger the security of the interconnected operation. (trigger cascaded tripping or the loss of a significant amount of load). In this case, the outage of a generating unit or transmission element will have no negative impact on the supply to customers.

Some of the tasks involved in Congestion Management are:

- Determine the maximum load ability of the network systems
- Manage the power transmission and distribution among valuable customers, priority-wise
- Installation of transformer taps for voltage regulation and loss control
- Generation rescheduling and curtailment of transactions

- Develop and impose congestion charges on the network users
- Enhance the maximum load ability limits of the network by improving the reactive power level
- Develop and enforce the use of area prices on some parts of the transmission network to control load on the network

The Indicator for this Function is **Compliance with the approved Procedures for Congestion Management,** which explain how the Interconnector congestion can be managed in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.1.6. Activity PRS-6: Coordination with neighbouring Control Areas and TSOs in cases of emergency (RMR, Art.23)

All conditions deviating from normal operation should be considered as abnormal conditions or emergencies. The system operator of the affected system should be obligated and therefore authorized to take all necessary measures to prevent any disturbance from spreading, and/or to ensure efficient restoration of supply. These measures should take priority over the individual interests of the system users.

In specific terms, each Control Area must contribute to the correction of a disturbance in accordance with its respective Contribution Coefficient for Primary Control. Contribution Coefficient is the ratio of the generation capacity of the Control Area to the generation capacity of the entire Interconnected Power System. Also, each Control Area must contribute to the Reserve Margin as required. The respective shares are defined by multiplying the calculated Reserve Margin of the entire Interconnected System and the Contribution Coefficients of the various Control Areas.

The Engineering and Operating Committee of WAPP determines the Contribution Coefficient of each Control Area on an annual basis and sets the values into operation on 1st January of the next year.

Some of the tasks involved in coordination with neighbouring Control Areas and TSOs in cases of Emergency are:

- All conditions deviating from normal operation to be considered as emergencies
- The system operator of the affected system to take all necessary measures to prevent any disturbance from spreading, and to ensure efficient restoration of supply
- A System Operator experiencing or anticipating operation under abnormal conditions to communicate its current and expected status to other neighbouring system operators and notify the SMO
- Other Power Systems capable of providing assistance to declare their capabilities
- As soon as a system anticipates that it could face operation under abnormal conditions, power station, distribution and transmission operators should be informed so that they can respond quickly and appropriately to the situation

- In case of an emergency, the main task for all systems is to maintain the stability of the WAPP Interconnected Power System. The system operator in whose system the emergency occurs should immediately take all possible measures to restore normal operating conditions

The Indicator for this Function is **Compliance with the approved Operation Procedures in emergency conditions,** which describe the detailed methodology for system restoration after a disturbance in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for system restoration.

10.1.7. Function PRS-7: Communication between the Control Areas, Domestic TSOs and the SMO (RMR, Art.25)

Each power system and Control Area should be equipped with adequate and reliable communication facilities internally and with other power systems and Control Areas to ensure exchange of information necessary to maintain the reliability of the interconnected power system. Procedures for Control Centre to Control Centre communication should be established by Power System and Control Area Operators to ensure that communications between operating personnel are consistent, efficient and effective during normal and emergency conditions.

Some of the tasks involved in the Communication between the Control Areas, Domestic TSOs and the SMO are:

- Each power system and Control Area should be equipped with adequate and reliable communication facilities internally and with other power systems and Control Areas to ensure exchange of information necessary to maintain the reliability of the interconnected power system
- Procedures for Control Centre to Control Centre communication to be established by Power System and Control Area Operators to ensure that communications between operating personnel are consistent, efficient and effective during normal and emergency conditions

The Indicator for this Function is **Compliance with the approved Communication Procedures between Market Institutions,** which describe the detailed methodology for communication between Control Areas, Domestic TSOs and the SMO, in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for establishing and maintaining communication between the Institutions.

10.1.8. Function PSR-8: Maintaining inter and intra-area flows (RMR. Art.23)

One of the key Functions of the Control Areas in the Regional Electricity Market is to ensure that inter and intra-area energy flows are maintained, both in quantity and quality (voltage and frequency).

The major task involved in maintaining inter and intra-area flows is

- to ensure that inter and intra-area energy flows are maintained in the Regional Electricity Market, both in quantity and quality (voltage and frequency)

The Indicator for this Function is **Compliance with the approved Procedures for Maintaining Inter and Intra-flows,** which details out the modalities for maintaining energy flows in the Regional

Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the procedures for maintaining inter and intra-flows in the REM.

10.1.9. Function PRS-9: Maintaining flows agreed at the regional level in the Interconnector (RMR, Art.25)

Each Control Area is physically demarcated by the geographical position of the delivery points for measurement of power interchanges to the remaining interconnected network. In each Control Area, the difference between the Day-ahead schedule and the real-time dispatch measured at the tie-lines between adjacent Control Areas (Area Control Error) must be kept close to zero at all times.

In order to keep the Area Control Error (ACE) close to zero, the control must be automatic. Each Control Area operator must utilize subsystem such as Automatic Generation Control (AGC) to automatically direct the loading of regulation reserve. AGC is used to limit the magnitude of the Area Control Error (ACE). In case of deficiency of the AGC, the concerned Control Area Operator should use manual control to adjust generation to maintain scheduled interchanges (flows).

The frequency and agreed power Interchanges (Day-ahead schedules) of the Control Area concerned are entered in the AGC as set point or reference values to guide control of the flows.

The algebraic sum of the agreed hourly schedules of Interchanges between a Control Area and adjacent areas constitutes the power interchange set point of the Control Area AGC.

Some of the tasks involved in maintaining the flows agreed at the regional level in the interconnector are:

- Each Control Area is physically demarcated by the geographical position of the delivery points
- Ensure that in each Control Area, the difference between the Day-ahead schedule and the real-time dispatch measured at the tie-lines between adjacent Control Areas (ie Area Control Error) must be close to zero at all times
- Make the control automatic in order to keep the Area Control Error (ACE) close to zero
- Ensure that each Control Area operator utilizes subsystems such as Automatic Generation Control (AGC) to automatically direct the loading of regulation reserve
- Ensure the use of the AGC to limit the magnitude of the Area Control Error (ACE).
- In case of deficiency of the AGC, the concerned Control Area Operator to use manual control to adjust generation to maintain scheduled interchanges (flows)

The Indicator for this Function is **Compliance with the approved Operation Procedures on flows in the interlinks,** which describe the detailed methodology for maintaining the agreed flows in the interconnectors in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for maintaining the agreed flows in the Interlinks.

10.1.10. Function PSR 10: Transmission Planning

Transmission Planning involves preparation of a long-term transmission programme that evaluates the current performance of the system and identifies new connection opportunities, based on the

Generation Adequacy Report from the SMO. The programme will include network improvement and investment plans. The Transmission Planner is responsible for assessing the longer-term reliability of Transmission network. By its very nature, Bulk Electric system planning involves multiple entities. Since all electric system within an integrated network are electrically connected, whatever one system does can affect the other systems. Transmission Planners coordinate their plans with adjoining Transmission Planners to assess the impact of or by these plans.

Some of the tasks involved in **Transmission Planning** are:

- Maintain and develop, in cooperation with adjacent and overlapping Transmission Planners, methodologies and tools for the analysis and simulation of the transmission systems, and the evaluation and development of transmission expansion plans
- Define, consolidate, collect or develop information required for transmission planning purposes
- Coordinate with adjacent and overlapping Transmission Planners so that system models and resources, and transmission expansion plans take into account modifications made to adjacent and overlapping Transmission Planner areas
- Evaluate, document, and report on expansion plans for the Transmission Planner area. Assess whether the integrated plan meets reliability needs
- Notify Generator Owners, Resource Planners, Transmission Planners and Transmission Owners of any planned transmission changes that may impact their facilities
- Define system protection and control needs and requirements to meet reliability needs

The Indicator for this Function is **Compliance with the approved Procedures for Transmission Planning,** which details out the steps and processes for planning transmission expansion and upgrades in the Regional Electricity Market. Compliance with the procedures is determined and monitored from observations, while the Benchmark associated with the Function is the availability of the Procedures for transmission planning.

10.1.11. Function PSR-11: Interconnection Capacity Allocation to Contracts (RMR, Art.30, & WTSAUP, Art. 2)

Access to Transmission Capacity in the Regional Electricity Market will be through allocation to bilateral contracts. In respect of each Dispatch Day, the responsible Domestic Transmission System Operator, the Control Area Operator, the Control Area Operator of the neighbouring Control Area and the SMO for the Regional Market, should, two days ahead, agree on the Total Interconnector Capacity available to be allocated in respect of the Interconnector in question. The Total Interconnector Capacity so determined should form the basis of transmission capacity allocation in the market. The System Market Operator should publish on its website the available Interconnector capacity so determined.

In cases of over-subscription, the Total Interconnector Capacity should be distributed amongst the Participants on the basis of the following rules:

- The SMO should not allocate any Interconnector capacity in response to any request for allocations of Daily Interconnector Capacity until all the requirements for Interconnector Capacity Entitlement have been fulfilled.

- In the event that the Total Interconnector Capacity is insufficient to meet the total requirements for Interconnector Capacity Entitlement that have fulfilled the condition, the SMO will make a pro-rata allocation of Interconnector Capacity Entitlement to each Participant

Such transmission capacity allocated cannot be transferred. If the transmission capacity allocated to a contract is not used or partially unused, the market participant has to declare it to the SMO and make it available for other market participants. ERERA should develop a set of penalties for cases of non-compliance with the conditions for the access to transmission capacity.

Some of the tasks involved in the **Interconnector Capacity Allocation to Contracts** are:

- Determine the Total Interconnector Capacity available to be allocated in respect of the Interconnector in question. Total Interconnector Capacity so determined shall form the basis of Interconnector Capacity allocation

- Publish on the website the available Interconnector capacity determined

- Accept all requests on pro-rata, if additional capacity is available on the Interconnector after all the requests have been satisfied

- Notify each Participant to whom capacity on the Interconnector has been granted based on Interconnector Capacity Entitlement, of the extent of the access granted provided that such notification shall be indicative only

- Approve Participant's request to assign all or part of its Interconnector Capacity Entitlement for a short-term

- Receive Interconnector Capacity Charge in respect of actual Interconnector Capacity to which the Participant is entitled and an Interconnector Usage Charge on the basis of the metered units of Energy imported or exported across the Interconnector

The Indicator for this Function is **Compliance with the approved Procedures for Interconnector Capacity Allocation,** which prescribes the detailed methodology for allocating interconnector capacity in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Interconnector Capacity Allocation.

10.1.12. Function PSR-12: Generation & Load Nomination

Participants in possession of an Interconnector Capacity Entitlement and Daily Interconnector Capacity Allocation should submit an Interconnector Energy Trade Nomination in respect of their desired Import or Export of Energy to the SMO on the day immediately preceding the Dispatch Day to which the nomination applies (a Day-ahead). The Interconnector Energy Trade Nomination applies to all Dispatch Periods of the Dispatch Day.

Each Generator should submit a Price Offer, indicating an offer to generate energy at a stated price in respect of each of its thermal Generation Groups. The price should reflect variable costs, taking into consideration fuel costs, heat rate, costs of operation and maintenance and environmental costs, if any. Also, For the Hydro Generation groups, each Generator shall submit a Price Offer, indicating an offer to generate energy at a stated price. The price should reflect the Opportunity Costs of hydro generation provided that the System Market Operator shall dispatch the energy offered in the Quantity Nomination economically within system constraints to minimise the total daily thermal cost plus hydro opportunity costs.

Some of the tasks involved in **Generation and Load Nomination** are:

- Participants with interconnector capacity entitlement and daily interconnector capacity allocation to submit interconnector Energy Trade Nomination, in respect of their imports or exports of energy, to the SMO, a day-ahead to the dispatch day
- Participants for the same transactions to submit separate Nominations for imports and exports in the same dispatch day
- Nomination to identify the Seller and its location in the adjacent Control Area, where Nomination is made in respect of an import
- Nomination to identify the Buyer and its location in the adjacent Control Area, where Nomination is made in respect of an export
- Energy amount nominated not to be greater than total interconnector capacity allocated to the participant
- In the event of a mis-match, the SMO and the relevant Control Area Operator to agree to changes to the import or export quantities or both, to achieve the necessary match

The Indicator for this Function is **Compliance with the approved Procedures for Generation and Load Nomination,** which prescribes the detailed methodology for Generation and Load Nomination in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Generation and Load Nomination.

10.1.13. Function PSR-13: Protective Relay Coordination (WAPP, P3.5)

Each Power System should implement a protection system, operation and preventive maintenance procedures, which will enhance the system reliability with the least adverse effect on the interconnection. Power system protection procedures should be made available to all appropriate system personnel and should provide for instructions and training where applicable.

Each protection device should be recalibrated at least once in a year. A review of the protection settings may also be carried out when required. Any improper operation of a protection device should be investigated immediately and rectified as soon as possible.

Neighbouring systems should be notified in advance of changes in generating sources, transmission, load or operating conditions, which may require changes in their protection systems and settings.

Some of the tasks involved in **Protective Relay Coordination** are:

- Each power system to implement a protective system to enhance the system reliability in the event of any adverse occurrence on the interconnection
- Coordinating all protective systems in the interconnected system
- Supervising the status of protective systems of each power system and notification of all relevant neighbouring parties of every change in status
- Recalibration of each protective device at least once in a year
- Reviewing the protection settings when required
- Investigating improper operation of a protective device and rectifying promptly
- Advance notification of neighbouring systems of changes in generating sources, transmission, load or operating conditions that may require changes in their protection systems

The Indicator for this Function is **Compliance with the approved procedures for Protective Relay Coordination,** which details out the modalities for protection coordination in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for protection coordination.

10.1.14. Function PSR-14: Reactive Supply and voltage Control on Tie-lines (WAPP OM, P3.6)

Reactive power flows in the tie-lines should be maintained at a minimum level in order to limit voltage drops and facilitate allocation of the total transfer capacity of the interlink mainly to active power. In order to ensure a safe operation of the interconnected system, the voltage levels at the boundaries need to be optimized. The voltage difference between the two ends of the tie-line should be maintained at a minimum level, as much as possible.

Reactive power generation scheduling, transmission line and reactive resources switching, etc, and load shedding, if necessary, should be implemented to maintain appropriate voltage levels.

In order to maintain transmission voltages on the WAPPITS within acceptable limits, generation facilities under the control of a Control Area operator should be operated to produce (or absorb) reactive power. Thus, Reactive Supply and Voltage Control from Generation Sources Service must be provided for each transaction on the Transmission System.

The amount of Reactive Supply and Voltage Control from Generation Sources Service that must be supplied with respect to the Transmission Customer's transaction will be determined based on the reactive power support necessary to maintain transmission voltages within limits that are generally accepted in the region and consistently adhered to by the SMO.

Reactive Supply and Voltage Control from Generation Sources Service is to be provided by the SMO by making arrangements with the Control Area operator that perform this service for the Transmission System. The Transmission Customer must purchase this service from the SMO.

Some of the tasks involved in **Reactive Supply and Voltage Control** are:

- Each Control Area Operator to operate its reactive resources to maintain voltages within established limits
- Limit voltage drop on tie-lines by maintaining reactive power flows at a minimum level
- Allocate total transfer capacity of the tie-lines mainly to active power
- Maintain voltage difference between the two ends of the tie-line at a minimum, as much as possible
- Make specific bilateral agreement to transfer reactive power through tie-lines if reactive power cannot be produced or absorbed in a Control Area
- Implement reactive generation scheduling, transmission line and reactive resource switching and load shedding to maintain appropriate voltage levels

The Indicator for this Function is **Compliance with the approved Procedures for Reactive Supply and Voltage Control on the Tie-lines,** which shows details of the process of voltage control on the tie-lines in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for reactive supply and voltage control on the tie-lines.

10.1.15. Function PSR-15: Coordination of Maintenance Scheduling (WAPP, P4.3)

WAPP interconnected power system should mutually agree on the most suitable schedule for maintenance work on the tie-lines, generating units, and facilities having a substantial impact on the interconnected power system. The interconnected system should coordinate the maintenance activity with the planned outages in transmission network, and agree with the power station operators on binding dates in this respect. Changes are only possible by mutual consent.

Routine maintenance of other equipment in the power system, such as control and communication equipment should also be coordinated with the maintenance of the power system elements.

Some of the tasks involved in the **Coordination of Maintenance Scheduling** are:

- WAPP interconnected Power Systems mutually agree on the most suitable schedule for maintenance work on tie-lines, generating units and facilities having impact on the interconnected power system
- When maintenance schedules are defined and agreed upon between WAPP interconnected Power Systems, each shall confirm weekly (and daily in case of changes) the outages of important power plants and transmission lines to affected neighbouring Power Systems
- Scheduled generating unit outages that may affect the reliability of interconnected power systems to be planned and coordinated among the WAPP interconnected Power Systems of affected Control Areas
- Each WAPP interconnected Power System collect relevant information on scheduled outages of power plants and transmit it to neighbouring WAPP interconnected Power Systems

- Routine maintenance of telemetering, control equipment and associated communication channels also to be coordinated between the WAPP interconnected Power Systems

The Indicator for this Function is **Compliance with the approved Procedures for coordinating Maintenance Schedules,** which describes the detailed methodology for coordinating maintenance schedules in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for coordinating maintenance schedules.

10.1.16. Function PSR-16: System Restoration (WAPP OM, P 5.3)

Restoration of the power system to normal operation after a system-wide collapse should be realised as fast as possible based on developed and verified plans, which should be agreed among the relevant parties. Each party should develop and periodically update a plan to restore its power system to normal conditions in an orderly manner in the event of a partial or total shutdown of the system. This plan should be coordinated with other parties to ensure effective restoration of the WAPP system. System restoration procedures should be verified by simulation or actual testing with physical elements of the power system. Telecommunication facilities used to implement the plan should be periodically tested. Operating personnel should be trained in the implementation of the plan.

Also, each Control Area should have a plan to continue operation of its System in the event that its main control centre becomes inoperable. This should include having a back-up control centre.

Some of the tasks involved in **System Restoration** are:

- Restoration of system to normal operation after a system-wide collapse is to be realized as fast as possible in line with the approved procedures
- Each Control Area to develop and periodically update a plan to restore its power system to normal conditions in the event of any collapse
- Such plans to be coordinated with neighbouring systems to ensure effective restoration of the WAPP system
- Such plans to include restoration of supply to plant auxiliaries from generating sources with black start capability
- Different parts of the WAPP interconnected system to be synchronized after restoration of frequency and voltage levels in each part

The Indicator for this Function is **Compliance with the approved System Restoration Procedures,** which details the necessary steps to be taken for system restoration in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for system restoration.

10.1.17. Function PSR-17: Transmission Service (WTSAUP, Art. 13)

The SMO is responsible for providing Firm and Non-Firm Point-To-Point Transmission Service subject to the applicable terms and conditions of WTSAUP. Point-To-Point Transmission Service is for the receipt of capacity and energy at designated Point of Receipt and the transmission of such capacity and energy to designated Point of Delivery. The minimum term of Firm Point-To-Point Transmission Service should be one day and the maximum term should be specified in the Service Agreement.

Long-Term Firm Point-To-Point Transmission Service is available on a first-come, first-served basis, in the chronological sequence in which each Transmission Customer has reserved service without prejudice to the Initial Allocation of Available Transfer Capacity (ATC).

Reservations for Short-Term Firm Point-To-Point Transmission Service will be conditional based upon the length of the requested transaction, the capacity of the requested transaction and relative impact on Available Transfer Capacity (ATC).

Some of the tasks involved in the provision of **Transmission Service** are:

- Receiving transmission service requests and processing each request for service according to the requirements
- Determination of Available Transfer Capability values
- Approving or denying of transmission service requests
- Approving Arranged Interchange from Transmission Service agreement perspective
- Allocating transmission losses among Balancing Authority Areas
- Providing the transmission services in the Wholesale Electricity Market

The Indicator for this Function is **Compliance with the approved Procedures for the provision of Transmission Service,** which details the modalities for the provision of transmission services in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the associated Benchmark is the availability of the Procedures for providing the transmission service.

10.1.18. Function PSR-18: Operating Reserve -Spinning Reserve Services and Frequency Control of the System (WTSAUP, Schedule 5)

Spinning Reserve Service is needed to serve load immediately in the event of a system contingency, to save the system frequency from large scale deviation from the standard. Spinning Reserve Service may be provided by generating units that are on-line and loaded at less than maximum output. It is the responsibility of the SMO to ensure availability of the Operating Reserve Services for frequency control. The Transmission Customer must either purchase this service from the SMO or make alternative comparable arrangements to satisfy its Spinning Reserve Service obligation. Unless the Transmission Customer makes alternative comparable arrangements, the SMO will obtain the service from the affected Control Areas, and the Transmission Customer shall pay the SMO for this service when the SMO provides this service. Charges to the Transmission Customer are to reflect only a pass-through of the costs charged to the SMO by that Control Area operator or other suppliers.

The SMO should pass through the revenues it receives for this service to the Control Area operator or other supplier providing the service.

Some of the tasks involved in **Operation Reserve and Frequency Control Services** of the system are:

- Spinning Reserve is provided to serve the load immediately in the event of a system contingency

- Spinning Reserve service may be provided by generating units that are on-line and loaded less than maximum output
- Transmission Customer to purchase the service from the SMO or make alternative arrangement to satisfy the obligation
- The SMO to obtain the service from the affected Control Area and provide same to the Transmission Customer
- The SMO to pass through the revenues it receives for the service to Control Area Operator or to other suppliers providing the service

The Indicator for this Function is **Compliance with the approved Procedures for providing Spinning Reserve Service,** which details the methodology for providing spinning reserve service in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for providing the spinning reserve service.

10.1.19. Function PSR-19: Transmission Loss Compensation (WTSAUP, Attachment M)

The Transmission Loss Compensation Procedure is used to quantify transmission energy loss that the Transmission Customer is required to replace to the Transmission Operator(s) under WTSAUP. The Transmission Customer should be responsible for replacing the losses due on a real time basis. The Transmission Customer should deliver the loss energy to the Control Area(s) affected by the transactions.

Each Transmission Operator should maintain a schedule showing its allocation of loss energy for the provision of transmission service on its system. For ERERA regulated Transmission Operators, these allocations should be based on ERERA's approved schedules. The SMO should develop a loss matrix once each year to show the composite loss factors for each transaction, as a percentage of the transaction, based on the total of each Transmission Operator's pro rata MW/km impact (Transaction Participation).

Some of the tasks involved in **Transmission Loss Compensation** are:

- The lost energy is the transmission energy loss that the Transmission Customer is required to replace or compensate the Transmission Operator for
- The SMO to calculate a loss matrix once a year to show the composite loss factors for each transaction, as a percentage of the transactions
- ERERA to approve the schedule of losses
- Each Transmission Operator to maintain a schedule showing its allocation of loss energy for the provision of transmission service on its system
- The SMO to allocate the replaced loss energy, as well as revenues from sale of losses, among the Transmission Operators using the ERERA approved procedure

The Indicator for this Function is **Compliance with the approved Procedures for Transmission Loss Compensation,** which shows the methodology for implementing Transmission Loss Compensation in the Regional Electricity Market. Compliance with the procedures is determined from observations,

while the associated Benchmark is the availability of the Procedures for Transmission Loss Compensation.

10.1.20. Function PSR-20: Curtailment of Firm Transmission Service (WTSAUP, Art. 13.6)

In the event that a Curtailment on the WAPPITS, or a portion of it, is required to maintain reliable operation of a System and the systems directly and indirectly connected with it, curtailments will be made on a non-discriminatory basis to the transaction(s) that effectively relieve the constraint. If multiple transactions require curtailment, to the extent practicable and consistent with Good Utility Practice, the SMO will curtail (or cause to be curtailed) service to Transmission Customers taking Firm Point-To-Point Transmission Service on a basis comparable to the Curtailment of service to the Transmission Operator's Native Load Customers (original customers), and to transmission customers taking firm transmission service under Grandfathered Agreements (Agreements executed before the Effective Date of the WTSAUP).

The SMO will notify all affected Transmission Customers in a timely manner of any scheduled Curtailments. In the event that a Transmission Customer fails to cease or reduce service in response to a directive by the SMO through a Control Area Centre (CAC) or a National Control Centre (NCC), the Transmission Customer shall pay any applicable charges, in addition to some operational penalty. The modality for the use of the operational penalty revenues is determined by ERERA.

Some of the tasks involved in the **Curtailment of Firm Transmission Service** are:

- If a curtailment is required on the WAPPITS to maintain a reliable operation, curtailment will be made on a non-discriminatory basis to the transactions that effectively relieve the constraints
- Transmission customer to make the required reduction upon request by the SMO, in the event of an emergency
- SMO can curtail any Firm Transmission Service, if in its opinion, an emergency condition exists which can impair the reliability of the transmission system
- Notification of all the affected transmission customers in a timely manner, by the SMO of any scheduled curtailment
- Payment of applicable charges by the transmission customer upon failure to reduce service in response to directive by the SMO

The Indicator for this Function is **Compliance with the approved Procedures for curtailment of Firm Transmission Service,** which shows the steps to be taken to curtail Firm Transmission Service in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for Curtailment of Firm Transmission services.

10.1.21. Function PSR-21: Provision of Ancillary Services (WTSAUP, Art. 3)

The SMO will facilitate and arrange for the provision of Reactive Supply and Voltage Control from Generation Sources Services. In order to allow the SMO to arrange for service of reactive supply and voltage control from generation sources, each Transmission Operator should maintain a schedule for offering such service.

All Transmission Customers are required to purchase these two services from the SMO based on approved charges. In addition, the Transmission Operators will continue to provide Scheduling, System Control and Dispatch Services related to transmission service under the WTSAUP. Each Transmission Operator must maintain a schedule showing the charges for such services. Any amounts charged to the SMO by a Transmission Operator for such service should be passed through to the Transmission Customer without mark-up.

Each Transmission Operator should maintain schedules which offer Regulation and Frequency Response Service; Energy Imbalance Service; Operating Reserve - Spinning Reserve Service; and Operating Reserve - Supplemental Reserve Service**.**

Transmission Customers should pay the SMO for providing any of these services directly. Each Transmission Operator's schedules for these services also should be available through SMO's WAEMIS. However, a Transmission Customer serving load within a Transmission Operator's Control Area is required to acquire these four Ancillary Services, whether from the Transmission Operator, or from a third party, or by self-supply.

Some of the tasks involved in the **provision of Ancillary Services** are:

- Reactive Power Regulation Services: to control the reactive power flows in order to keep determined voltage levels
- Frequency Regulation Services: to control the system frequency by maintaining the real time balance between generation and demand of the active power
- Spinning Reserve Services: designed to respond to uncertainties and for maintaining the integrity of the transmission system and for maintaining the balance between supply and demand
- Black Start Services: to be provided at the strategic parts of the grid to restart the grid after collapse

The Indicator for this Function is **Compliance with the approved Procedures for the provision of Ancillary Services,** which details the modalities for the provision of Ancillary Services in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for the provision of Ancillary Services.

10.1.22. Function PSR-22: System Operator Certification (WAPP OM, P8.2)

Operation of an interconnected power system in most countries is coordinated through the national Load Despatch Centres in collaboration with the generation and transmission control centres. Prompt actions by the System Operator during the minute-to-minute operations, as well as during system emergency situations is critical for the reliability of the power system. It is therefore mandatory that all the power system control centres must be manned round the clock by qualified and adequately trained personnel. As a result, a system of certification of System Operators by independent bodies must be put in place to be responsible for training, testing and issuing certificates to successful System Operators.

The Syllabus for the certification examination should include courses in Power Sector Overview, Power System Operations, Electricity Market Operations, Research and Analysis, Regulatory Affairs, Systems

Data Acquisition, Energy Management, Communication, IT system and other establishment services to carry out the assigned functions.

The System Operator Certification program provides the framework for operators to obtain Certification from a Certification Authority. The program promotes reliability of the power system by ensuring that employers have a workforce of System Operators that meet the minimum qualifications. The System Operator Credential is a personal credential that the Certification Authority issues to a person for successfully passing a System Operator Certification Examination. The System Operators are monitored to ensure they maintain their required credentials to work in the System Control Centres. Each credential focuses on a specific functional area of System Operations.

Certification is maintained by completing approved Credential Maintenance Program Courses and activities. Operators maintain each Credential by accumulating a specified number of Continuing Education Hours (CEHs) within a specified period of time.

Some of the tasks involved in **System Operator Certification** are:

- Ensure an Authorization to Test (ATT) is obtained. The ATT is necessary for the candidate to schedule an examination
- Schedule an examination appointment. Once the ATT number is acquired, an appointment for testing can be scheduled for the candidate
- Ensure the relevant examination is passed to obtain a Certificate
- Ensure that Certified Operator retain appropriate documentation for proof of credential maintenance to continue working for the System Operator

The Indicator for this Function is **Compliance with the approved Procedures for System Operator Certification,** which details the processes for the certification of system operators in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for the certification of System Operators.

10.1.23. Function PSR-23: Generation Adequacy Analysis (WAPP OM, P4.1.2)

Each year, the SMO should prepare a report known as the Load Projection Report, of the monthly energy and system peak load forecast for the next ten (10) years. The forecast should identify projections for each Load Participant (i.e. Distributor, Load Serving Entity, Purchase-Selling Authority, etc.) and total for the system.

Each Load Projection Report should describe for each month of the ten-year period covered:

a. forecast system peak load and energy consumption for each month of the year;
b. the system generation capacity requirement for the forecasted system peak load, including reserves;
c. forecast energy consumption of each Distributor;
d. expected new connections;
e. need for generation capacity reserve, if any, in each region due to expected transmission constraints;

f. best location for new generation capacity; and

g. available free capacity in international Interconnectors.

The SMO should send the proposed Load Projection Report to ERERA for review and approval before publication in each year. ERERA may, if necessary, require corrections to load forecast assumptions, and approve the Load growth forecast contained in the Load Projection Report before publication.

The SMO should publish the approved Annual Load Projection Report on its website.

Each year, the SMO should prepare a Generation Adequacy Report over a ten year horizon, describing for each month of the next 10 years:

a. The forecasted monthly generation capacity requirement; for each Distributor and total for the system;

b. The generation capacity bought in contracts by each Load Participant, using the information in the Contract Register and information submitted by Participants on Contracts that are in the procurement or negotiation stage;

c. The generation adequacy, reflecting any expected shortfall or available reserve, which should be calculated by subtracting the generation capacity contracted for as determined in paragraph (b) from the forecasted monthly generation capacity determined in accordance with paragraph (a), for each Distributor and total for the system.

The comparison of the monthly Projected Load against the monthly Forecasted Generation, over the horizon period indicates the generation adequacy of the Market. The SMO should submit the preliminary version of the Generation Adequacy Report to ERERA for review and approval. The approved report should be published on the Website

Some of the tasks involved in **carrying out Generation Adequacy Analysis** are:

- Generation Adequacy Assessment involves evaluating the ability of the generating units to match system demand growth
- Every year, each interconnected power system to establish a power balance forecast that has to be included in the system reliability Report
- The power balance forecast to be for a 10-year horizon
- Each interconnected system to determine the difference between the reliable available capacity and the demand (Remaining Capacity)
- The Remaining Capacity to be available for use to cover loads above forecast demand or plant unplanned outages greater than expected

The Indicator for this Function is **Compliance with the approved Procedures for the Preparation of Generation Adequacy Report,** which details the methodology for generation adequacy analysis in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the procedures for analysing generation adequacy.

10.2. Commercial Functions

The Commercial Functions are those Market Activities that have bearing with the development and commercial stability, and efficient functioning of the Regional Electricity Market. Whereas the Technical Functions have direct relationship with the behavior of the power system, the Commercial Functions have direct relationship with the behavior of the electricity market. The indicators of these Functions, which are indicators for market preparation, are monitored as part of the regional electricity Market Surveillance

10.2.1. Activity REM-1: Drafting and Approving of Regional Market Rules (Regulation C/REG.27/12/07, section e.18)

One of the principal requirements of an electricity market design is the **Market Rules**. These Rules establish the general procedures and principles to administer the wholesale electricity market. The Rules also establish the relationships or interactions, rights and obligations between the Market Participants and the Market Service Providers (such as the Market Operator, the System Operator and the Transmission Service Provider). All those trading in the wholesale electricity market are bound by the Rules**.** An organised electricity market cannot exist without rules, which are mandatory for all participating or providing services in the market.

The Regional Market Rules define a general framework to enter, participate and trade in the Regional Electricity Market that, in principle, is non-discriminatory, promotes economic efficiency and creates sufficient predictability and transparency to provide comfort and security to the investors. The entity that developed the Regional Market Rules is WAPP, while it was approved by ERERA. It is generally important to have such Rules tested before operationalization, to ensure achievement of the desired objectives, such as transparency and efficiency in the operation of the market.

Some of the tasks involved in **Drafting of the Regional Market Rules** are:

- Set out the responsibilities of Participants, and service providers, in relation to market operation
- Set out the Operation and Pricing System of the Balancing Market
- Provide for an efficient, transparent, and predictable Settlement System and set out the payment obligations
- Establish a governance mechanism and a monitoring system
- Provide an efficient and transparent process for amending the Regional Market Rules and the Operation Manual

The Indicator for this Function (Development of the Regional Market Rules) is **Compliance with the Market Design Provisions**, which specified the processes and methodology for developing the Market Rules. Compliance with the Market Design provisions in the development of the Market Rules is determined from observations, while the Benchmark associated with this Function is the availability of the Market Rules.

10.2.2. Function REM-2: Drafting of Regional Market Procedures (RMR, Art.7, section 2)

The Market Procedures are the detailed modalities to clarify interpretations and to describe the methodology and standards for implementation and application of the Marker Rules. Also, the Market Procedures are important for clear understanding and efficient implementation of the Market Rules, and for the efficient administration of the electricity market. The Entity that developed the Regional Market Procedures is WAPP, in consultation with the Stakeholders, for approval by ERERA

Some of the tasks involved in the **Drafting of the Regional Market Procedures** are:

- Provide procedures for the registration and admission of participants in the market
- Provide the detailed procedures for market metering
- Provide detailed procedures for market settlement
- Provide detailed procedures for market billing and payments

The Indicator for this Function is **Compliance with the relevant Provisions** of the **Market Rules**, which specifies the principles and methodology for developing the Market Procedures. Compliance with the Market Rules in the development of the Market Procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Market Procedures.

10.2.3. Function REM-3: Resolution of Unforeseen Circumstances in the Electricity Market (RMR, Art. 10)

If circumstances arise which have not been foreseen in the Regional Market Rules (RMR) or in the WAPP Operation Manual, and in respect of which provisions have not been made in the documents, the SMO should, if practicable and possible, consult promptly with ERERA with a view to reaching an agreement on the manner to deal with the circumstances. Immediately after the situation has been solved, the SMO should initiate the procedures for an amendment to the Regional Market Rules or the Operation Manual as established in the Market Rules, to provide for such circumstances.

In all cases where it is not possible or practicable to consult with ERERA within the time available for the SMO to perform its functions, the SMO should proceed with its functions, and inform ERERA after. The unforeseen circumstances, as well as the measures taken should be referred to the WAPP Executive Board for review. Also, the proposals for amending the Rules or the Manual to cover the unforeseen circumstances, should be submitted to the WAPP Executive Board

Some of the tasks involved in the Resolution of Unforeseen Circumstances in the Electricity Market are:

- Consult promptly with ERERA for an agreement on how to deal with the circumstance
- If there is no time to consult, SMO to take actions to address the issues and inform ERERA accordingly
- Refer the unforeseen condition and the actions taken to WAPP for review
- SMO to initiate procedures for amendment of the RMR immediately after the situation has been solved

The Indicator for this Function is **Compliance with the approved Procedures for resolving unforeseen conditions in the Market**, which specifies the methodology for resolving such unforeseen conditions in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for resolving unforeseen conditions in the regional electricity market.

10.2.4. Function REM-4: Market Settlement (RMR, Art.38)

Market Settlement is the function of determining the electrical quantities delivered by the Generators and quantities received by the Load Participants (i.e Load-Serving Entities, Eligible Customers, Purchasing-Selling Agencies) in the Wholesale Electricity Market. Apart from the quantities, Market Settlement also involves the determination of who pays what, and who receives what from the market. Most disputes in the electricity markets typically arise from issues on the settlement processes.

Some of the tasks involved in **Market Settlement** are:

- Calculation of Energy and generation capacity sold and bought in the Contract Market
- Where applicable or agreed between the Participants and the System Market Operator, contract prices and payment due from contracts
- Transmission charges and
- System Operation and Market Administration Charges

The System Market Operator (SMO) should administer the market settlement system on a monthly basis and should develop and maintain the requisite software, data and results of the market settlement system.

The Indicator for this Function is Compliance with the approved Market Settlement Procedures, which specify the processes for Settlement determination in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.2.5. Function REM-5: Market Invoicing & Payment (RMP, Art. 22)

Within a reasonable time after the first day of each month, the SMO should submit an invoice to the Transmission Customer for the charges for all services furnished under the WTSAUP during the preceding month. Trading between Market Participants is substantially bilateral, so billing and payments should be direct between the parties to the Agreement. However, billing and payments for the market services of transmission use-of-system, market operation, system operation and regulatory charges are between the participants and the SMO. The SMO also stands in for billing and payments in respect of the ancillary services and balancing market services.

The invoices should include

- All Settlement Statements to which the invoices relate
- The net amount to be paid to or by the SMO
- The payment date and time
- Any amount outstanding from overdue payments in relation to previous Settlement Statements

Some of the tasks involved in **Market Invoicing and Payment** are:

- SMO to issue settlement invoice, which must include Settlement Statement to which the invoice relates, the net amount to be paid to or by SMO, payment date and time, any amount outstanding from overdue payments
- SMO to maintain an account with a Settlement Bank
- Market Participants to use Electronic Funds Transfer facility for payment purposes
- All invoices to be paid within 14 days from issuing date[11]

The Indicator for this Function is Compliance with the approved Market Billing and Payment Procedures, which specify the processes for Market Billing and Payment in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.2.6. Function REM-6: Market Monitoring and Surveillance (RMR, Art. 20)

Generally, this Function involves ensuring compliance by all the Stakeholders, with the provisions of the Market Regulatory Documents. Market Monitoring and Surveillance Functions include the investigation and identification of market design flaws, identification of inadequacies of the procedures in the market documents, and developing approaches to address the design flaws and inadequacies of the procedures. It includes the Monitoring of the efficiency of the Market Structure, Market Architecture and the Market Rules, to correct as early as possible any flaws and inadequacies, and propose mechanisms to solve or mitigate any problem in the Rules or its implementation, before they have time to lead to significant market failures.

Market monitoring activities also include the preparation of monthly and annual reports to provide the status of, and developments in the monitored markets with the analysis of market trends and early warnings of market conditions that could create problems.

Specifically, it is the responsibility of the SMO to monitor and investigate the behaviour of Market Participants regarding how they are using their allocated Transmission Capacity and if they are declaring correctly ex-ante, the use of this capacity. The SMO should also keep ERERA informed about any manipulations and irregularities in the REM.

Some of the tasks involved in **Market Monitoring and Surveillance** are:

- Ensure Participants' compliance with the RMR and the Market Procedures
- Ensure breaches of RMR and the Procedures are reported promptly
- Investigate into alleged breaches of RMR or Procedures
- Ensure SMO compliance with guidelines when issuing warnings about alleged breaches by Participants
- Ensure SMO compliance with the procedures for bringing proceedings in respect of breaches of the RMR or the procedures to ERERA

[11] ECOWAS Regional Electricity Market Procedures, Article 22: Invoicing and Payment, 2017

The Indicator for this Function is Compliance with the approved Procedures for Market Monitoring and Surveillance, which explain the concept and show how the Function can be implemented in the regional electricity market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.2.7. Function REM-7: Admission and Registration of Market Participants (RMR, Art. 27)

This Function involves the receipt of application for admission, reviewing and verifying the applications, and recommending the application to the Regional Regulator for approval, in accordance with the procedures for application for admission in the Market. The Entity responsible for the development of the procedures for the admission of Market Participants and for the administration of the participants' registration process in the Regional Electricity Market, is the Regional Market Registrar, while the Regulator is responsible for approving the procedures.

Anyone planning to participate in the Regional Electricity Market must apply to the Registrar for admission to participate in the market. The participant admission process allows the Registrar to ensure that the applicant meets the eligibility criteria and will satisfy the prudential and financial obligations to the Regional Market, and also establishes the applicant's technical ability to inter-operate within the Regional Market. For the purpose of this Function, the SMO is the Registrar.

Some of the tasks involved in the **Admission and Registration of Market Participants** are:

- SMO to develop Procedures, including Forms for applying for admission to the REM
- The Procedures and Forms to be approved by ERERA and publicised in the SMO's and ERERA's website
- Applicants for market participation to complete the approved Forms following the approved Procedures
- Applicant participant to receive a unique identification once accepted as market participant, and integrated in the register of market participants
- ERERA to give final approval for market participation

The Indicator for this Function is **Compliance with the approved Procedures for Admission and Registration of Market Participants,** which explain the steps the SMO takes to implement Participant's admission and registration in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.2.8. Function REM-8: Meeting Prudential Requirements for Market Participation (RMP, Art. 10 - 15)

Prudential Requirements for participation in the Regional Electricity Market are those requirements (technical and commercial) that will make for continuous participation of the participants in the market, as well as make for viability and financial stability of the Market. Complying with these requirements imply meeting the financial security and other criteria which may be established from time to time by the SMO and approved by ERERA, in the course of the operation of the Regional Electricity Market.

Some of the tasks involved in **Meeting the Prudential Requirements for Market Participation** are:

- SMO to determine the Credit Limit (CL) for each Market Participant (MP) and reviewed every year
- SMO to notify each MP of its CL, including any revisions
- MPs to inform the SMO of any circumstance that may result in an increase in the Participant's CL
- MPs to ensure that SMO always holds the benefit of a Credit Support/Guarantee in an amount not less than the Credit Limit
- SMO to reject any submission from an MP that may result in the Participant's Trading Limit being exceeded
- SMO to issue a Margin Call notice when a Participant's Trading Margin equals to or is less than zero

The Indicator for this Function is **Compliance with the approved Prudential Procedures for Market participation,** which explain the details of the prudential requirements for participation in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.2.9. Function REM-9: Suspension of Participants from Participation in the REM (RMP, Art. 23)

A Suspension Event occurs if:

- A Market Participant fails to make a payment by the time it is due
- A Market Participant is in breach of a Prudential Obligation
- The SMO has drawn on a Credit Support or Guarantee in relation to the Market Participant, and the payment under the Credit Support or Guarantee is not received by the SMO within 90 minutes of being requested
- The Market Participant ceases or threatens to cease to carry on its business or a substantial part of its business related to its participation in the Regional Electricity Market

An obligation of the Market Participant is that it must promptly notify the SMO as soon as it becomes aware that a Suspension Event has occurred in relation to it, with full details of the Event. Both the SMO and the Participants have roles to play towards preventing suspension of the participant from participating in the Market. If the Event is not remedied within the timeframe provided in the Procedures for suspension of Participants from participating in the Regional Electricity Market, then suspension of the Participant becomes inevitable.

Some of the tasks involved in the **Suspension of Participants from Participating in the REM** are:

- Participants to notify the SMO promptly after becoming aware of any event of default in the RMR
- SMO to issue to the participant a Default Notice, specifying the alleged default and request the participant to remedy the default within a specified period
- SMO to notify ERERA, the CAs and the DTSOs of any such Default Notice

- SMO to Issue a Suspension Order to the participant if the event of Default is not remedied within the period stipulated
- Immediately after issuing the Suspension Order, SMO to publish a notice on the website stating that the rights of the participant to participate in the market, has been suspended or restricted

The Indicator for this Function is **Compliance with the approved Procedures for Participant Suspension from Market participation,** which explain the details of the steps and processes for suspending a Participant from participation in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.2.10. Activity REM-10: Determination of Market Fees (RMP, Art. 34)

Market Fees are the fees collected by the SMO from the Market Participants for the operation of the Regional Electricity Market. Such Fees include:

- Market Operation fees
- System Operation fees
- Regulatory fees
- Market Participation Application fees
- Balancing fees
- Ancillary Services fees
- Any other fees required for the Regional Market

Every year, the SMO must determine its budget, and based on the budget determine the level of the Market Fees, for approval by ERERA. Fee rates should be set at a level that the SMO estimates will earn revenue equal to the relevant estimate of the expenditures of the SMO and ERERA operations. Also, the level of each type of Application fee must reflect the estimated average costs to the SMO of processing that type of Application and may be different for different classes of Market Participants.

Some of the tasks involved in the **Determination of Market Fees** are:

- Fees collected by the SMO from the Market Participants for the operation of the regional market are: market operation fees, system operation fees, regulatory fees, market participation application fees
- At a set time each year, the SMO should determine its budget and fee rates and submit to ERERA for approval
- In the event of delay in the approval process, SMO should use the budget and fee rates approved for the previous year
- Publish, before November 30th each year, the level of fee rate that will apply from January 1st the next year
- Fee rates should be set at level that the SMO estimates will earn revenue equal to the estimate of expenditures of the SMO and ERERA operations

The Indicator for this Function is **Compliance with the approved Procedures for the determination of Market Fees,** which gives the considerations and detailed methodology for determining the Fees applicable in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures.

10.2.11. Function REM-11: Submission of Market Data (RMP, Art. 37 & 38)

The Market Data in question here are the generation and load demand data. For the Day Ahead Market, each day, every Market Participant will submit data for the subsequent day of operation, concerning each particular transaction scheduled for each hour, in a particular direction, of a particular border interconnector. The data should be submitted in the format prescribed by the SMO. If for any reason, the information from any Participant is not available for any hour, the SMO should assume the data to be zero.

Based on the submissions, the SMO will check if the planned exchange (i.e. transactions) between the two Market Participants on both sides of the border interconnector, at a particular hour and in a particular direction equals each other. If they are not equal, the SMO will adopt the lower of the two to ensure supply/demand balance and stability of the system. The SMO should inform the affected Participants accordingly.

Some of the tasks involved in the **Submission of Market Data** are:

- SMO to specify the form of communication for market data submissions
- Participants to include their detailed particulars, each time submission is made
- Participants to maintain communication line, and report any changes promptly
- Market Operations Department (MOD) to receive report regarding forecast availability (NTC), from the System Operations Department (SOD), each day
- Market Participants (MPs) to submit data concerning transactions, for the next day of operation, each day
- Data to be submitted in the format prescribed by the SMO
- Data assumed to be zero for any participant whose information are not available
- MOD checks if planned transactions between the two MPs on both sides of the border are equal or not
- MOD to conduct further checks for the availability of NTC with respect to the scheduled transactions
- MOD to produce schedule of transactions based on which the MPs submit data for the day of operation to the respective TSOs

The Indicator for this Function is **Compliance with the approved Procedures for Market Data submission,** which describe the process, time-table and format for submission of Market Data in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Market data submission.

10.2.12. Function REM-12: Contract Market Administration

Contract Market includes all the Bilateral and Day-ahead trading arrangements between participants, including participants in different electricity markets or regional pool, who buy and sell energy from the market.

Part of this Function is ensuring that all energy traded in the Market is bought or sold through Bilateral Contracts. The SMO also ensures that a Balancing Mechanism is in place to settle differences by establishing and maintaining a Contract Register in which contract information, such as power contracted from Generators and bought by each Load Participant and other relevant information, provided by the Participants, will be kept.

Some of the tasks involved in **Contract Market Administration** are:

- Prepare Contract Market Procedure, in accordance with the Market Rules
- Establish and maintain a Contract Register in which contract information, provided by the Participants will be kept
- Register contracts that meet all the requirements for registration, and notify both parties to the contract accordingly

The Indicator for this Function is **Compliance with the approved Contract Market Procedures,** which describe the timetable, format and mechanisms for the exchange of information and contract nominations in the Contract Market, in accordance with the Regional Market Rules. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Market Contract Procedures.

10.2.13. Function REM-13: Day-ahead Market Scheduling (WTSAUP, Art. 13.8)

Each Transmission Operator should submit to its Control Area Centre a daily energy schedule for flows in order to allow it to prepare and submit to the SMO a daily aggregated energy schedule for hourly flows of its Area consistent with the times for energy scheduling for Daily Firm Point-to-Point Transmission Service. Each Control Area Centre also should provide day ahead generating unit commitment schedules.

Some of the tasks involved in **Day-ahead Market Scheduling** are:

- Receive bids and offers to buy and sell energy and ancillary services for each hour of the next day
- Determine the system marginal price as the offer price of the marginal unit
- Rank generators according to their offer prices
- Develop a schedule that results in a single market price and volume for each hour.

The Indicator for this Function is **Compliance with the approved Procedures for Day-ahead Market Scheduling,** which describe a transparent methodology for Day-ahead Market Scheduling in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Day-ahead Market Scheduling.

10.2.14. Function REM-14: Dispute Resolution (RMR, Art. 40)

Dispute Resolution is a process of resolving disputes between parties. As the electricity sector continues to undergo changes as a result of privatization, liberalization, and convergence, there are multiple opportunities for disputes to arise within the electricity market. It therefore becomes increasingly important to have an effective and efficient dispute resolution system, to avoid possible

protracted litigation processes in the law courts. The regulator's quasi-judicial power to resolve disputes is critical to ensure the effective operation of the market. In most cases, the regulator employs the Alternative Dispute Resolution (ADR) methods in Dispute resolution. The ADR is the use of methods such as Negotiation, Expert determination, Mediation and Arbitration to resolve disputes instead of litigation.

Any dispute between a Transmission Customer and the SMO involving transmission service under the WTSAUP (excluding applications for rate changes or other changes to the WTSAUP, or to any Service Agreement entered into under the WTSAUP), shall be presented directly to ERERA for resolution and shall be referred to a designated senior representative of the SMO and a senior representative of the Transmission Customer for resolution on an informal basis as promptly as practicable.

In the event the designated representatives are unable to resolve the dispute within thirty (30) days, the Parties should resolve the dispute in accordance with the relevant provisions of the Regional Market Rules.

Also, an effective system to enforce the Dispute resolution decisions is essential in order to give effect to the rules necessary for maintaining order, growth and development of the sector.

Some of the tasks involved in **Dispute Resolution** in the Electricity Market are:

- Developing a Dispute Resolution Procedure applicable to the electricity market
- Sending to the other Party a written request to conciliate, by the Party who wishes to initiate conciliation.
- Filling of notice of dispute, by the Party alleging existence of dispute, to the Dispute Resolution Entity, with a copy to the other party (the Respondent), setting out the material particulars of the dispute.
- Serving a written Response on the Applicant, by the Respondent, with a copy of the Response to the Dispute Resolution Entity
- Referring Dispute to a person, such as an Independent Engineer (for Expert Determination), who has expertise in the subject matter to which the dispute relates for a fast-track resolution
- Resolving Dispute through Mediation. The Mediator does not make decisions for the parties, but assist the parties to arrive at a mutually acceptable solution
- Use Arbitration when Disputes cannot be resolved through informal or any of the fast-track formal mechanisms. Arbitrator's decision is final and binding

The Indicator for this Function is **Compliance with the approved Dispute Resolution Procedures,** which describe a clear, transparent and credible process for resolving disputes in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for resolving Disputes in the regional Market.

10.2.15. Function REM-15: Development of Model Market Participation Agreement (RMR, Art. 28.3)

Market Participation Agreement is the Agreement under which the SMO and each Participant agree to observe and perform the requirements of the Regional Market Rules and the Operational Manual,

including any amendments of the documents. The Entity that develops and enforces this Agreement for the Regional Electricity Market is the SMO.

The Market Participation Agreement (MPA) sets out the terms of participation of any Participant in the Regional Electricity Market, and execution of same is a condition for registration in the Regional Electricity Market. The MPA will continue to bind the SMO and each Participant until such a time as the Participant ceases to be a Participant in line with the Regional Market Rules. The relevant MPA terminates at any time the Participant ceases to be a Market Participant.

Some of the tasks involved in the **Development of Model Market Participation Agreement** are:

- Establishing the SMOs commitment to its liability and obligation to the Market Participants
- Establishing the Participant's acknowledgement of the SMO's rights and authority over it
- Establishing commitment of the Market Participant to the Regional Market Rules and the Operation Manual
- Ensuring that both parties to the Agreement sign the amendments to make any amendments effective
- Providing for the Market Operator to be informed by the MP of any changes in any condition and information submitted in its Admission Application

The Indicator for this Function is **Compliance with the approved Procedures for the development of Market Participation Agreement,** which gives the detailed processes for developing the Participation Agreement for the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures.

10.2.16. Function REM-16: Market Metering (RMR, Art. 37)

All tie-lines from Control Area to adjacent Control Area must have meters in operation to record the actual active power flow in MW in real-time and the energy in MWh during the period of power exchange. All tie-line measurements (MW & MWh) should be telemetered to the Control Centres located at both ends of the tie-line, and to the Control Area Operators, and in parallel to the SMO, using a common agreed type and make of metering systems. The Metering System should be specified by a properly qualified person as stated in the Metering Code.

The SMO, in collaboration with the Transmission Operator should be responsible for the provision, installation and maintenance of the main metering and communication equipment to accurately account for the capacity and energy being transmitted under the WTSAUP at the Point of Receipt and Point of Delivery in accordance with the metering and communications standards of the SMO, and to post the information related to these metering and communication equipment on the SMO's Market Information System (WAEMIS).

Unless otherwise agreed, the Transmission Customer should be responsible for the cost of installing and maintaining the main metering and communication equipment. Also, the Transmission Customer should have the responsibility for the provision and installation of back-up metering and communication equipment at the Point of Delivery at its own expense in accordance with the metering and communication standards of the SMO. The Transmission Customer should communicate to the SMO the information related to these metering and communication equipment.

Unless otherwise specified in an agreement for the construction of facilities, such equipment installed on the Transmission Customer's system should remain the property of the Transmission Customer. Also, unless otherwise specified in an agreement for the construction of facilities, such equipment installed on the Transmission Operator's system should remain the property of the Transmission Operator.

Some of the tasks involved in **Market Metering** are:

- Draft and implement the Market Metering Procedure in line with the Metering Code, detailing the methods and timetable for reading and submitting Meter Data
- Install complete Commercial Metering systems, with the associated communication system, at all the Connection Points of Participants and Interconnectors, which are also referred to as Trading Points
- Install complete check metering system to provide a backup for the main metering system
- Organize, validate and, where necessary, correct the Meter Data received from Participants, in order to establish the Metered Quantities applicable to each Participant for the settlement process
- Test and inspect the Metering Installations to ensure credibility of energy measurements at all times
- Notify any failure, inaccuracy or defect in a Metering Installation and take immediate steps to repair, replace, and/or recalibrate the metering device

The Indicator for this Function is **Compliance with the approved Metering Procedures,** which describe the methodology for selection, installation, calibration, programming and reading of the Market Meters in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for Market Metering in the Regional Market.

10.2.17. Function REM-17: Implementation & publication of Market Audit (RMR, Art. 21)

At least once every year, the SMO should contract an independent auditor to conduct an operational audit of the system operation and the market operation services, including the settlement system, price calculation methodology, dispatch and any procedures relevant to the SMO Controlled Grid and Administered Market, in accordance with the Operation Manual and Regional Market Rules. Specifically, Market Audit involves reviewing the efficiency and consistency of the Market Procedures, Operating Procedures and other practices employed by the SMO in relation to trading, pricing and settlement systems, and Ancillary Services. It also involves the evaluation of the level of compliance of the SMO's internal and business processes with the RMR, as well as the level of compliance of the SMO with the RMR and Market Procedures.

The SMO should publish on its website, in the public domain, the Market Auditor's Report within 30 days of receiving ERERA's approval of the report. The SMO should also publish on its website, in the public domain any report it prepared within 5 days after ERERA's approval of the report, including recommendations made by ERERA if any.

Some of the tasks involved in **implementing Market Audits** are:

- Evaluate the compliance of the SMO's internal and business processes with the RMR
- Evaluate the SMO's compliance with the RMR and the Market Procedures
- Assess the neutrality, efficiency, transparency and predictability of the SMO services in the regional electricity market
- Assess the processes and systems employed by the SMO in undertaking dispatch, price calculation, metering data management and settlement
- Evaluate SMO's market software systems and processes
- Review the efficiency and consistency of the Market Procedures, Operating Procedures and other practices employed by the SMO in relation to trading, pricing and settlement systems, and Ancillary Services
- Prepare an audit report containing its findings, together with recommendations for possible improvements
- Publish report on the Website for access by all Participants, after ERERA's approval

The Indicator for this Function is **Compliance with the approved Procedures for Market Audits,** which describe the detailed methodology for selection of Market Auditors and implementation of the Audit of the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for implementing the Audit in the Regional Market.

10.2.18. Function REM-18: Energy Imbalance Service (WTSAUP, Schedule 4)

In compliance with the Regional Market Rules and the Regional Electricity Market Procedures, Energy Imbalance Service is provided when a difference of more than +/- 3% occurs between the scheduled and the actual delivery of energy to a load located within a Control Area over a single hour. According to the Regional Market Procedures, the Transmission Customer must either purchase this service from the SMO or make alternative comparable arrangements to satisfy its Energy Imbalance Service obligation. Unless the Transmission Customer makes alternative comparable arrangements, the SMO will obtain this service from the affected Control Areas or elsewhere, where appropriate, and the Transmission Customer shall pay the SMO for the service. Charges to the Transmission Customer are to reflect only a pass-through of the costs charged to the SMO by that Control Area operator or other suppliers. The SMO should pass through the revenues it receives for this service to the Control Area operator or other suppliers providing the service.

Some of the tasks involved in **Energy Imbalance Services** are:

- Transmission Customer to purchase the service from the SMO or make alternative arrangement to satisfy the obligation
- The SMO to obtain the service from the affected Control Area or elsewhere and provide same to the Transmission Customer

- The SMO to pass through the revenues it receives for the service to the Control Area Operator or any other supplier providing the service

The Indicator for this Function is **Compliance with the approved Procedures for Energy Imbalance Service,** which details the methodology for providing energy imbalance service in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for providing energy imbalance service.

10.2.19. Function REM-19: Electricity Market Clearing[12]

When there is vigorous wholesale market competition, centralised dispatch is no longer determined by the SMO using estimated incremental costs for each generating plant. Instead, a bid-based system, in which individual generators submit their own price offers every day to the SMO to meet the expected customer demand for the next day is used.

In the market clearing system, Buyers submit bids and Sellers submit supply offers. The SMO then develops the aggregate supply and demand curves and finds the clearing price at which supply and demand balance. That is where the supply and demand curves cross.

The Market Clearing Price (MCP) is the lowest price obtained at the point of intersection of the aggregate supply and demand curves and the volume of power at the point of intersection is called the Market Clearing Volume (MCV). At this price both suppliers of generation and purchasers of power are satisfied and would provide enough electricity from accepted sales offers to satisfy all the accepted purchase bids.

The Real-time market is designed to provide opportunities for the generators that are available but not selected in the Day-ahead scheduling, to be patronized in the electricity market.

Some of the tasks involved in **Electricity Market Clearing** are:

- Monitor the credit worthiness of the Market Participants
- Provide a guarantee fund that can be used to cover losses that exceed a defaulting clearing firm's collateral on deposit
- Conduct payments flows on the power exchange (physical settlements)
- Plot the graphs of bids from Buyers and offers from Suppliers
- Determine clearing price and clearing volume by the interplay of demand and supply curves

The Indicator associated with this Function is **Compliance with the approved Procedures for Electricity Market Clearing,** which describe the modality for determining the MCP and MCV in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the performance Benchmark associated with the Function is the availability of the Procedures for Electricity Market Clearing.

[12] Kumar N, Verma R, Singla S., "Analysis of Market Clearing Price (MCP) in Deregulated Electricity Market", International Journal of Scientific & Engineering Research, Vol. 5, October 2014

10.2.20. Function REM 20: Electricity Market Reconciliation[13]

Electricity Market Reconciliation process includes data collection, validation, estimation (especially in the absence of accurate measurements), storing and archiving. The Market Reconciliation entity receives Volume Information or data from the Market Participants (i.e. Generator Operators, Load-Serving Entities and Purchasing-Selling Agencies) and determines the quantity of electricity generated by each Generator, and purchased by each Load-Serving entity and Purchasing –Selling agency at each Network Supply Point (NSP). Market reconciliation tries to ensure that at all times, just as much power is fed into the grid as is taken from it (baring efficient network losses), and that the value of invoices issued by the Generator Operators will match the total revenues collected by the Load-Serving entities, the Purchasing-Serving agencies and any other load participant in the market in respect of power generation, using the tariffs approved by the Regulatory Authority. The reconciliation entity establishes both energy and revenue balances in the electricity market and this function is carried out by the SMO in the REM.

Some of the tasks involved **Electricity Market Reconciliation** are:

- Delineate the Electricity Market according to the Balancing Authority Areas
- Allocate power in the electricity market to the Reconciliation Participants (i.e., Generator Operators (GO), Load Serving Entities (LSE), Purchasing-Selling Authority (PSA)), within the Balancing Authority Areas
- Collect and store information on electricity generated by the GO (energy and capacity), and on electricity received (energy and capacity) by the LSE and the PSA
- Collect and store information on the electricity sold by the LSE and PSA
- Collect and store information on the invoices from the Generator Owners to the LSE and the PSA for energy delivered, and on the revenues collected on energy and capacity sales by the LSE and PSA
- Reconcile the electricity generated against electricity purchased and sold, applying any best practice methodology.
- Reconcile the generation invoices against the total revenues collected on electricity sales, applying any best practice methodology
- Determine level of losses in the electricity market using the results of the reconciliation
- Evaluate the efficiency of the electricity market using the results of the reconciliation

The Indicator associated with this Function is **Compliance with the approved Procedures for Electricity Market Reconciliation,** which describe the detailed process for implementing energy and revenue Reconciliations in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the performance Benchmark associated with the Function is the availability of the Procedures for Electricity Market Reconciliation.

[13] "Reconciliation Methodology Guidelines Version 1.0", The Market Operator's Team, Electricity Authority of Wellington, New Zealand, January, 2015

10.2.21. Function REM-21: Transmission Tariff Regulation (TTMW, Section 4)

This involves development of appropriate methodology which can be adopted across the ECOWAS countries for the determination of cross-border transmission tariffs. The methodology is approved by ERERA. The methodology should be applied for the calculation of transmission tariffs in the countries which are buying and selling power, as well as the intermediate countries through whom the power might flow.

There are a number of key issues which need to be covered within the Transmission Tariff. These are:

- Responsibility for determination of, and payment for, losses incurred as a result of the energy trading flows along the interlink, including the relevant transmission lines used within the countries;
- Use of system charges, covering:
    - Operation and maintenance costs;
    - Return on equity and allowance for depreciation; and
- Costs incurred as a direct result of the resolution of transmission constraints caused by the energy trading flows, e.g. cost of congestion.

The core principles of Transmission Tariff Setting are:

- **To promote efficiency** by providing appropriate price signals to generation and demand, giving incentives for appropriate investment and promoting competition.

- **To recover efficient costs** – Security in cost recovery lowers the risk of investment, and hence cost of capital.

- **To be transparent**, fair and predictable, to encourage new market participants. Ideally the methodology should be easy to explain and should be stable in the long-term, avoiding "price shocks".

- **To be non-discriminatory**, i.e. treat network users who have the same impact on the transmission network equally.

Some of the tasks involved in **Transmission Tariff Setting** are

- Establish the legal basis for the regulation of transmission tariffs

- Determine the regulatory approach to be adopted for the tariff calculation

- Review the filing made by the Transmission Licensee, to ensure consistency and completeness.

- Determine the regional transmission assets and asset value.

- Calculate the Annual Revenue Requirements (ARR) for the regional transmission services. The ARR shall consist of Operation and Maintenance expenses, Return on Capital employed, Return of Capital employed, less non-tariff incomes and incomes from other businesses

- Determine the total energy units transmitted on the transmission grid during the year

- Calculate the unit price for cross-border trading on the interconnector.

The Indicator for this Function is **Compliance with the approved Methodology for Setting Transmission Prices,** which prescribe the detailed steps and procedures for setting Transmission Prices in the Regional Electricity Market. Compliance with the Methodology is determined from observations, while the Benchmark associated with the Function is the availability of the methodology for Transmission Price Setting

10.2.22. Function REM-22: Exchange of Market Information (RMP Art.17)

Control Area Operators should exchange all information and data related to network topology, active and reactive flows, sums of scheduled exchanges and to some extent, the pattern of generation. These data will be used to perform real-time and forecast calculations for network security and also for congestion forecast for weeks and day-ahead. Also, each Control Area Operator should determine with other neighbouring Control Area Operators the suitable set of real time data to be exchanged on-line.

These Market data need to be organised such that they are usable for the mentioned purposes. There are also the general rules for data handling and the rules that the relevant Institutions of WAPP should follow for the provision and usage of these data.

Some of the tasks involved in the **Exchange of Market Information** are:

- Collect information for Registration of Market Participants
- Exchange of basic data for both energy injection and energy extractions
- Communication of information on trading of energy between the generators and Distribution Service Providers, Eligible Customers, and Energy Traders
- Communication of planned energy trade, production, and consumption to the Market Operator
- Report planned energy schedule to the System Operator for congestion management

The Indicator for this Function is **Compliance with the approved Procedures for Exchange of Market Information,** which describes the processes for mining, handling and exchange of Market Information in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Market Information exchange.

10.2.23. Function REM-23: Contract Registration (RMR, Art. 29.2)

The System Market Operator should establish and maintain a Contract Register in which it will register and keep contract information disclosed to it by Participants. The Contract Register should not contain any price or other commercially sensitive information. The Contract Register should document the power contracted from each Generator and bought by each Load Participant.

Upon entering into a new contract in the Market, each Participant must notify the SMO of the contract and request registration thereof. The SMO should publish on its Website, the form to be utilised by Participants in requesting registration of a contract or notifying the SMO of changes to a registered contract. The form should request all the information required by the SMO for proper discharge of its functions.

Some of the tasks involved in **Contract Registration** are:

- SMO to establish and maintain contract registration in which it will register and keep contract information disclosed to it by the Market Participants (MPs)
- Contract register not to contain any commercially sensitive information, such as prices
- Contract register to document power contracted from each generator and bought by each load participant
- Each MP to notify the SMO upon entering into a new contract, and request registration of same
- SMO to publish on its website, the form to be utilized by the MPs to request registration, or to notify of changes to a registered contract

The Indicator for this Function is **Compliance with the approved Procedures for Contract Registration,** which prescribes the detailed steps and processes for contract registration in the Regional Electricity Market. Compliance with the Methodology is determined from observations, while the Benchmark associated with this Function is the availability of the procedures for contract registration.

10.2.24. Function REM-24: Electricity Market Balancing

Electric load fluctuates constantly, and grid users are responsible for their individual balances. This means that generators should as much as possible match their generation with what they sell, while large power consumers or suppliers should match their consumptions with what they purchase. Any changes in load demand that is not off-set by a corresponding change in resource schedules requires the Market Balancing Authority to meet the demand by purchasing electricity or by compensating generators to reduce generation. In either case, the expense is recouped from the Market Participants. This additional power (or reduction in power) is purchased in the "Balancing Market". Energy purchased in the Balancing Market (Balancing Energy) covers the shortfalls in demand that schedules do not meet. This allows Owners of undedicated generation to sell power into the Balancing Market.

Sometimes, energy may be over-scheduled, meaning more energy is scheduled than is demanded. In this case, the Market Balancing Authority will pay the Generators in the Balancing Market to reduce generation. Again, the Market Balancing Authority recoups the cost from Market Participants representing the load

Generally, imbalances in the market are discouraged with fines based on the cost of regulation, apart from paying for the reserve power that the SMO procures from the grid to alleviate the overall imbalance in the Market.

Some of the tasks involved in **Electricity Market Balancing** are:

- Maintain the balance (minimize the imbalance) of the balancing group
- Sign balancing group agreements with balancing group members
- Trade with other balancing groups to reduce imbalance energy services
- Settle with the Balancing Authority for imbalances for each settlement period.

- Allocate and collect fees for imbalances from each of the balancing group members for each invoice period

The Indicator for this Function is **Compliance with the approved Procedures for Market Balancing,** which prescribes the conditions and modality for Market Balancing in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for Market Balancing.

10.2.25. Function REM-25: Purchasing and Selling

This Activity involves the purchasing and selling, and taking of titles to energy, capacity and interconnected operations services in the Regional Electricity Market. Purchasing/Selling Entities may be affiliated or unaffiliated merchants and may or may not own generating facilities. Some of the specific tasks involved in this Activity are:

- Arrangement for Transmission services from Transmission Service Providers, as well as arrangements for reliability-related services with Generator Owners or Load-Serving Entities
- Selling of electricity to the end-users according to contracts approved by the National Regulatory Authority (NRA)
- Payment of Generators for electricity supplied
- Payment of applicable charges for transmission services and system operations and market administrative charges, including cost of Ancillary Services
- Payment of Distribution Service Providers for distribution services under rates approved by the NRA
- Receipt of payments from end-users for electricity supplied under tariffs approved by the Regulator
- Request implementation of Arranged Interchange

The Indicator for this Function is **Compliance with the approved Procedures for Purchasing and Selling,** which describes the modality for wholesale Purchasing and retail Selling of electricity in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the procedures for wholesale purchase and retail sell of electricity.

10.2.26. Function REM- 26: Application for Transmission Service (WTSAUP, Art.17.1)

A request for Firm Point-To-Point Transmission Service for periods of one year or longer must contain a written Application to the SMO, at the designated address on the West African Electricity Market Information System (WAEMIS) at least sixty (60) days in advance of the calendar month in which service is to commence. A Completed Application should provide such information as the following:

a. The identity, address, telephone number, facsimile number and e-mail address of the entity requesting service;
b. A statement that the entity requesting service is, or will be upon commencement of service, an Eligible Transmission Service Customer under the WTSAUP;
c. The location of the Point(s) of Receipt and Point(s) of Delivery and the identities of the Delivering Parties and the Receiving Parties;

d. The location of the generating facility(ies) supplying the capacity and energy and the location of the load ultimately served by the capacity and energy transmitted;
e. A description of the supply characteristics of the capacity and energy to be delivered;
f. An estimate of the capacity and energy expected to be delivered to the Receiving Party;
g. The Service Commencement Date and the term of the requested Transmission Service; and
h. The transmission capacity requested for each Point of Receipt and each Point of Delivery on the West Africa Power Pool Interconnected Transmission System (WAPPITS); customers may combine their requests for service in order to satisfy the minimum transmission capacity requirement.

The SMO should treat this information consistent with the standards of conduct relating to Confidentiality stated in the Regional Market Rules.

Some of the tasks involved in the **Application for Transmission Service** are:

- A transmission Customer may sell, transfer or assign its rights under its Service Agreement to another Transmission Customers (the Assignee)
- Transmission Customer who intends to assign its rights (Assignor) to be compensated, but compensation should not exceed the original rate paid for the right
- Assignee to receive the same services as did the Assignor, if the Assignee does not request any change in points of delivery or receipt or any change in any other term or condition of the original Agreement
- SMO to be notified by the Assignor as soon as possible after the assignment occurs
- Assignee to pay additional charge consistent with the provisions of WTSAUP, if changes are requested in the points of delivery, receipt or any other condition of the Agreement

The Indicator for this Function is **Compliance with the approved Procedures for Application for Point-to-Point Transmission Service,** which describes the steps and requirements for Participants to apply for Transmission Service in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for application for Transmission Service.

10.2.27. Function REM-27: Amending the Market Rules (RMR, Art. 41)

In exercise of its mandate, ERERA approved the **Regional Market Rules (RMR)** in 2015, to define the general framework to enter, participate and trade in the Market, and to ensure sufficient predictability and transparency of the market to provide certainty, transparency and security to Participants and investors. The Rules also specify the rights and obligations of the various entities operating in the market

Given the fact that there may be some unforeseen conditions or evolving market trends in the electricity market which were not provided for in the Market Rules, the RMR will need to be amended from time to time. The amendment process will be through a regulated procedure as established in the Market Rules

The proposal for amendment to the Market Rules may be initiated by:

i. The SMO

ii. ERERA

iii. The WAPP Executive Board

iv. A domestic regulatory authority of one of the WAPP's member countries.

v. A group of at least four Market Participants

A proposal for amendment of the Rules should be in the form of a written submission filed with ERERA. The submission should identify any provision of the rules in respect of which the person making the submission considers that an amendment or review may be necessary or desirable and should include a statement of the reasons for which the amendment to or review of the rules may be necessary or desirable. ERERA should examine and decide on the Amendment Submission according to its decision-making procedures concerning the regional electricity market. ERERA may approve or reject the proposed amendment after consideration.

Some of the tasks involved in the **Amendment of the Market Rules** are:

- SMO to regularly prepare Rules Report describing problems experienced in the implementation of the Rules and submit to ERERA
- SMO or ERERA, any NRA or the WAPP Executive Board to make proposal for amendment of the Rules
- Proposal for amendment to be filed with ERERA
- Identify in the proposal any provision of the Rules requiring amendment, stating the reasons for the amendment
- ERERA to examine and decide on the proposal according to its decision-making procedures
- ERERA to approve or reject the proposed amendment if there are reasons to do so

The Indicator for this Function is **Compliance with the approved Procedures for the Amendment of the Market Rules,** which describes the processes for amending the Rules for the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the Procedures for amendment of the Regional Market Rules.

10.2.28. Function REM-28: Enforcement of Compliance with the Regional Market Rules, Market Procedures and WAPP Operation Manual (RMR, Art. 42)

The SMO, Domestic TSOs, Market Participants and Transmission Service Providers should comply with the RMR, Regional Market Procedures and the WAPP Operation Manual as well as any amendment or modifications made to them that have been dully approved following the prescribed procedures.

The SMO should ensure compliance with these Rules, Procedures and Operation Manual by all Market Participants and all Domestic TSOs or Transmission Service Providers. The SMO should file a complaint with ERERA for any breach of any of these Rules/Procedures.

Any Participant that has evidence that another Participant or any Domestic TSO or any Transmission Service Provider has violated or is violating provisions of the Rules or the Operation Manual may file a complaint with the SMO. In the case where the SMO is suspected to have violated or is violating the Rules or the Operation Manual, the Participant may file a complaint with ERERA.

ERERA is responsible for the enforcement of the RMR and the WAPP Operation Manual, and for this purpose, ERERA has developed procedures to deal with breaches and the corresponding sanctions.

Operational Breaches are minor or significant (not major) breaches that are related to the direct operation of the REM and for which ERERA has delegated the SMO, by a provision of the Market Procedures, the duty to investigate and impose operational penalties as provided by regulations. There are Non-Operational Breaches, the investigation and compliance enforcement of which ERERA does not delegate

Some of the tasks involved in the **Enforcement of Compliance with the Market Rules, Market Procedures and the WAPP Operation Manual** are:

- Develop, maintain and implement a Compliance Enforcement process
- Evaluate and document compliance
- Investigate and resolve alleged violations of the Market Regulations/Standards
- Identify eventual Gaps in the Regulations/Standards through compliance monitoring
- Impose a penalty for violation of the Regulations/standards after notice and opportunity for hearing, subject to the Compliance Authority's decision

The Indicator for this Function is **Compliance with the approved Procedures for the Enforcement of Compliance with the Market Rules, Market Procedures and WAPP Operation Manual,** which describe the processes for enforcing compliance with the Regulations in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with the Function is the availability of the Procedures for compliance enforcement.

10.2.29. Function REM-29: Retaining Market Records (RMR, Art. 43)

The SMO will develop and publish a list of all information and documents relating to the Regional Electricity Market activities that the Market Participants shall keep. Effective from the date of the publication, the Market Participants must keep all the information or document in the list. Additionally, the SMO shall, in accordance with Market Procedures, set and publish the confidentially status of each type of the market related information or document.

ERERA should develop, publish, and from time to time revise, a policy detailing the period for which Records of Market Information or classes of Records prepared by the SMO, the Domestic TSOs, the Transmission Service Providers and Participants for or in connection with the Market Rules and the Operation Manual must be retained. The SMO and each Participant should retain Records or classes of Records prepared for or in connection with the Rules and the Operation Manual for such period of time as may be specified in the policy referred to above.

Where no period of time is specified in respect of a given Record, the Record should be retained for a period of five years which shall run:

- in the case of the person that created the Record, from the date on which the Record was created; and;
- in the case of the person that received the Record, from the date on which the Record was received.

Some of the tasks involved in **Retaining Market Records** are:

- ERERA to develop, publish and from time to time revise the policy on the retention of Market Records produced by the SMO, DTSO, TSP and the Market Participants (MPs)
- ERERA to specify the period of time for the retention of the records by the Entities
- Where no period of time is specified for a given record, the record is to be retained for 5 years
- All persons to have open and non-discriminatory access to all information in possession of the SMO, except the confidential information
- All information, except the confidential ones to be made available to the MPs or other persons, to be published by the SMO on the website

The Indicator for this Function is **Compliance with the approved Policy for Retaining Market Records,** which details the modalities for retaining market records in the Regional Electricity Market. Compliance with the policy is determined from observations, while the Benchmark associated with the Function is the availability of the Policy on the retention of Market Records.

10.2.30. Function REM-30: Maintenance of Participant's Information (RMR Art.43)

The SMO should organise, maintain and publish the Participants' Register on the Website. The Participants' Register should, amongst other things, state whether or not a Participant or Applicant Participant has been suspended from the Market or has notified the SMO of its intention to withdraw from the Regional Electricity Market.

The SMO should update the Participants' Register upon the occurrence of any of the following events:

i. admission of a new Participant;

ii. suspension of a Participant, to indicate the Suspension Notification; and

iii. cessation of participation in the Market by a Participant for any cause whatsoever, to remove the Participant from the Participants' Register.

In relation to Applicant Participants, the SMO will include in the Participants' Register the date on which the application form was presented and current status of processing the application.

On being informed of a change in the information filed by a Participant, the SMO should promptly update the Participant's entry in the Participants' Register.

Some of the tasks involved in **Maintaining Participants' Information** are:

- SMO to enter in the Participants' Register, the Participant's information contained in the Participant's Admission Application and the information furnished by the Participant pursuant to the admission requirements, upon admission
- SMO to allocate a unique identification code to each participant. For a Participant who is a Generator, this should be utilised by the SMO to issue Dispatch Instructions
- SMO to update the Participants' Register upon the admission of new participants, suspension of a participant or cessation of participation by a participant, to remove the participant from the participant Register
- The SMO to organise, maintain and publish the Participants' Register on the Website

- The SMO to include in the Participants' Register the date in which the application form was presented and current status of processing the application
    - SMO to promptly update the Participant's entry in the Participants' Register, upon being informed of a change in the information filled

The Indicator for this Function is **Compliance with the approved Procedures for the Maintenance of Participant's Information,** which details the modalities for maintaining participant's information in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated with this Function is the availability of the procedures for maintaining participant's information.

10.2.31. Function REM-31: Assignment or Transfer of Transmission Rights (WTSAUP, Art. 23)

Subject to ERERA's approval, a Transmission Customer may sell, assign, or transfer all or a portion of its rights under its Service Agreement, but only to another Eligible Transmission Service Customer (the Assignee). The Transmission Customer that sells, assigns or transfers its rights under its Service Agreement is hereafter referred to as the Reseller. Compensation to the Reseller should not exceed the higher of the original rate paid by the Reseller or the maximum rate on file under WTSAUP at the time of the assignment.

If the Assignee does not request any change in the Point(s) of Receipt or the Point(s) of Delivery, or any material change in the terms or conditions set forth in the original Service Agreement, the Assignee will receive the same services as did the Reseller and the priority of service for the Assignee will be the same as that of the Reseller. A Reseller should notify the SMO as soon as possible after any assignment or transfer of service occurs but in any event, notification must be provided prior to any provision of service to the Assignee. The Assignee will be subject to all terms and conditions of WTSAUP.

Some of the tasks involved in the **Assignment or Transfer of Transmission Rights** are:

- A transmission Customer may sell, transfer or assign its rights under its Service Agreement to another Transmission Customers (the Assignee)
- Transmission Customer who intends to assign its rights (Assignor) to be compensated, but compensation should not exceed the original rate paid for the right
- Assignee to receive the same services as did the Assignor, if the Assignee does not request any change in points of delivery or receipt or any change in any other term or condition of the original Agreement
- SMO to be notified by the Assignor as soon as possible after the assignment occurs
- Assignee to pay additional charge consistent with the provisions of WTSAUP, if changes are requested in the points of delivery, receipt or any other condition of the Agreement

The Indicator for this Function is **Compliance with the approved WTSAUP Procedures for Assignment or Transfer of Transmission Rights,** which details the applicable processes necessary for assigning or transferring transmission service from a Reseller to an Assignee in the Regional Electricity Market. Compliance with the procedures is determined from observations, while the Benchmark associated

with this Function is the availability of the Procedures for implementing the transmission service transfer.

11. Proposed Methodology and Processes (for collecting, verifying, validating, and analyzing data) for regional market surveillance

The core Market Monitoring and surveillance activities include:

a. Identification of fraudulent behavior by market participants, as well as detection of attempts to engage in fraudulent behavior, including unilateral behavior resulting in gaming or abuses of market power, through data activities, and support of regulatory enforcement.
b. Market Performance: detecting whether Market Rules and Procedures provide efficient incentives, and lead to efficient market outcomes
c. Reporting of Breach which may be detected through data verification and validation: Where a breach is suspected, the breach must be reported, using the approved reporting process, to ERERA, who has the responsibility for investigation and compliance enforcement. ERERA may however, assign parts of these responsibilities to SMO, subject to approved procedures
d. Identification of the activities of the SMO, CAs and the DTSOs that may have impact on market efficiency or effective competition: Any participant that has evidence that another participant , the DTSO , Control Area or the SMO has violated or is violating any provisions of the Regulation, may file a complaint with ERERA, following the approved reporting procedure, for investigation.
e. Identification of actual or potential market design flaws and inefficiencies in the Market Rules and Procedures, that may create opportunities for market manipulations.
f. Implementation of appropriate mitigation schemes: from the results of the investigations, appropriate responsive actions are taken to address any undesired impacts of a strategic conduct and market design flaws. These responsive activities include mitigation and punitive actions in the short-term and market redesign proposal in the long-term.

Market Monitoring involves not only observing and measurement of inappropriate market behavior, but also includes mitigation of such behavior. Mitigation of inappropriate market behavior is designed to preclude or eliminate, as well as to deter such abuses. The basic idea is to prevent certain conducts before they result in inappropriate market behavior or to penalize conducts that are inappropriate market behavior.

Markets that are monitored include

- Energy Market
- Capacity Market
- Ancillary Service Market
- Interconnection Capacity Market

11.1. Data

Data is "factual information used as a basis for reasoning, discussion or calculation"[14]. Data can be qualitative or quantitative, depending on how they are expressed. Qualitative data is expressed either in a verbal or narrative format, while quantitative data is expressed in numerical terms. Data is numbers, characters, images, or other method of recording, in a form which can be assessed to make a determination or decision about specific action. Data is the index for market monitoring at the micro level. Many believe that data on its own has no meaning, only when interpreted does it take on meaning and become information. The box below illustrates the difference between data and information

- *The number 10GWh is one example of data*
- *The amount of power generated from a power plant in Nigeria in 2021 is "10GWh" is information*

11.2. Data Collection

Data collection refers to the process of acquiring and gathering a number of data sets. There is no universally accepted set of Market Monitoring Statistics and indices. In practice, there is a large set of data and indices that are monitored on varying time scales. Such data consists of both public domain information or public data release (e.g. wholesale market outcomes, network measurements, etc) and confidential information (such as market participants' asset information and bids and offer prices). A major benefit of public data release is that all market participants are aware that their bids schedules and output levels are publicly available. The fact that their behavior is directly observable is likely to make detection of market Rule violations very easy. Any interested party can monitor the behavior of any participant using this publicly available data. Despite the many market advantages of public data release, few markets do so.

The following groupings serve as a useful guide for data collection management, for market monitoring:

11.2.1. Data on Market prices, Demand and system conditions

The level of market prices is the most critical to monitor in market monitoring. A moderate increase in market price can be a sign of market abuse if it comes at a time when demand is low. This means that prices must be related to system conditions, most importantly the level of demand, but also the level of available capacity and indications of transmission congestion. These indices are typically reported on a monthly, seasonal and an annual basis, but should be collected for every period in which the market is operating

[14] Introduction to Data Analysis Handbook, Migrant and Seasonal Head Start Technical Assistance Centre, 2006

The raw data collected by the Market Monitor can be differentiated from the statistics that are subsequently derived from them. Under the **Market Prices, Demand and System Conditions**, the raw data can include:

- Price
- Demand conditions
- Capacity availability
- Transmission congestion

Given that these raw data are available, there are some statistics that can usefully be derived and monitored for signs of any distortions in the market, such as

- Price Trends
- Price Comparisons
- Price Setting Analysis
- Demand and Capacity Analysis
- Congestion Analysis

11.2.2. Market Structure Indices

The raw data on Market Structure Indices consist of information on generator shares and on price responsiveness of demand

- Market Share: Market shares for each generator can be collected. These can be based on shares of capacity or of output. When output shares are used, they can be collected at various frequencies, ranging from hourly to annual.
- Demand Responsiveness: The responsiveness of demand to changes in price affects generators' ability to exploit a large share of the supply side of the market and drive up its price

11.2.3. Supplier Indices and Analysis

The focus of Supplier Analysis is on the behavior of individual generators which might have market power. In this case raw data consist of bid and outage information. Bid information is to check on commercial withholding, while outage information checks on physical withholding. The initial task in this analysis is to obtain reference bids, which indicate how each unit behaves in normal condition. These will not identify a sustained abuse of market power, but a change in conduct in response to a short-term change in circumstances will be spotted.

- Market Bids: The full set of bids to each organized market must be available to the market monitor, including prices, availability and any technical constraints taken into account when setting prices. If a generator bid price exceeds its marginal or opportunity cost, this may constitute an exercise of market power.

- Outages: data should be held on the number and duration of de-ratings, including the number of MW by which the unit's capacity is reduced, and scheduled and forced outages
- Reference Bids: These can be produced for each market into which a unit normally bids (eg day-ahead, real-time, etc). Reference Bids can be accepted Bids in competitive periods or information obtained through consultations with market participants. This is historical information.

- Bid Variation: Changes in the unit's bids related to the abuse of market power, can be identified through deviation of bids from reference levels.
- Analysis of Bidding: This can include:
    - Correlation between bids and levels of demand
    - Correlation between bids and existence or magnitude of congestion
    - Correlation between bids and the market price
- Analysis of Outages: This can include:
    - Correlation between outages and market prices
    - Comparison of outage frequencies of similar generator

11.2.4. Market performance indices and analysis

There are some indicators of market performance that are easily collected. Others require complicate calculations. The easy to collect indicators are:

- Liquidity Measures: The volume of trade in a market relative to the underlying physical demand is a measure of liquidity
- Spot Market Exposure: This can be measured by monitoring the percentage of load that is bought under long-term forward contracts

Table11.1: Summary of Market Monitoring Indices

Statistics	Category	Frequency	Data Required
Market Prices and System Conditions			
Price Trend	Ex-post	Hourly, Daily and Monthly	Spot, forward and fuel prices
Price Comparison	"	"	"
Price Setting Analysis	"	Daily, Monthly	"
Demand and Capacity Comparisons	"	"	Demand data, generation Capacity, generation offered
Congestion Analysis	"	"	Transmission Constraint data
Market Structure			
Market Share	Ex-ante	Daily, Monthly, Annually	Generator Capacity or Sales, Transmission Constrain Data
Demand Responsiveness	Ex-post	Monthly, Annually	Demand Data
Supplier Indices			

Bid Correlation Analysis	Ex-post	Daily, Monthly	Bid data, Demand and Congestion data
Outage Analysis	"	Monthly, Annually	Outage data, demand, cost and price
Market Performance			
Liquidity Measures	Ex-post	Daily, Monthly	Bid Price and Volumes
Spot Market Exposures	"	"	"

The above data and information on the market and on market participants, can be collected through:

- Information provided to the SMO by the market participants, Control Areas, Domestic TSOs, and any other relevant stakeholder
- Information collected by the SMO itself on its compliance or otherwise with the Market Regulation
- Outage information

Templates should be generated for data collection and submission.

11.3. Data Verification and Validation

Data verification is the screening tests on data that may serve to flag those participants' conducts that may suggest inappropriate behavior and the need for further analysis, to identify the nature of the problem

Data validation is an activity aimed at verifying a set of values as acceptable for the intended purpose. It assesses the plausibility of the data in question. A positive outcome of data validation does not guarantee that the data is correct, while a negative outcome guarantees that the data is incorrect. Data validation is a decisional procedure ending with an acceptance or refusal of data as acceptable.

The purpose of data validation is to ensure a certain level of quality of the final data. The quality dimension under focus here is related to accuracy. There are three phases of Data Validation for market surveillance. These are:

- The first phase is automatic and done by the software at the moment of data submission. It is recommended that special, custom-made software/program be developed by ERERA for use by market participants to report electronically. If a correlated data is missing (e.g. there are quantities but no prices), the report is automatically rejected and the data provider is requested to make a specified correction and resubmit.
- The second phase is a manual process. If there are non-logical data (e.g. instead of KWh, data is presented in MWh), report will be rejected with a message on what corrections are required
- The third phase of data validation is part of the process of data analysis. In this case, data are checked, where necessary, explanation or corrections are asked for. Validation process includes cross-checking data with data already processed in the database. Also, data reports from other sources are used for comparison. Significant deviations are subject to further checks and request for explanation. After all the consultations and checks, the data may be considered valid for storage

11.4. Data Analysis

Data Analysis is the application of procedures on data collected in order to obtain some information. As stated above, data is raw material from which information is obtained. One of the strategies for data analysis is **Trend Analysis**, which involves looking at data collected at different periods of time, to identify and interpret changes. Once data has been collected, the next step is to analyze it. The most general goal of Trend Analysis is to look at data, comparing one time period to another time period. Data analysis process is a series of connected activities designed to obtain meaningful information.

A critical market data analysis activity for market monitoring focuses on the identification of market power exercise, the strategic behavior of a market participant in an attempt to gain excessive wealth transfers from other participants, typically from demand-side entities. The analysis results indicate whether such strategies are implemented by physical withholding, economic withholding or creating a local transmission congestion, and what their impacts are to the market outcomes.

Analysis is also aimed at the identification of market conducts that take unfair advantage of Market Rules. Such conducts may result, not only in market inefficiency but also in reduced system reliability

11.5. Data protection

The validated and analysed data are stored in the database, and these provide the resource for periodic market reports from the regulator. Also, the data privacy of the market participants should be respected and protected by the regulator, while producing and sharing such reports

The regulation provides for the protection of those market data that are commercially sensitive. Where any such sensitive data must be shared, there are procedures stipulated for access to such confidential information. The procedures will include privacy obligations on the recipient of the information.

12. Coordination framework for key stakeholders involved in the regional electricity market surveillance

The **Regional Market** is the outcome of establishing a higher hierarchical level of organization of several national markets, so that their original interactions become stronger and subject to well-defined commonly agreed rules. Besides enabling energy imports and exports, interconnected power networks impact a series of additional benefits such as improved system reliability, reduced reserve margins, reactive power support, etc. However, all electricity markets around the world have experienced a sustained period with the exercise of significant market power, market manipulations and other abusive behaviours. The markets that have fared the worst are those that did not have prospective market monitoring process in place. The California market is the best-known example.

It is therefore expected that the introduction of the Regional Electricity Market will come with market misconducts at a regional dimension. Electricity Regulators, both national and regional, should strengthen their surveillance, supervision and co-operative efforts to deal with such issues whenever they are observed. Also, the Regional System and Market Operator (SMO) will have a number of interface areas with the Domestic TSOs and the Control Areas to address surveillance issues at the Regional Market. Also, such interface areas will need to be strengthened.

12.1 Cooperation at national and regional level between ERERA and National Regulatory Authorities

Some of the interfaces between ERERA and the NRAs in respect of addressing issues in connection with regional electricity market surveillance are as follows:

- It is the responsibility of the NRAs to issue licenses to the Participants, while ERERA approves the Participants participation in the REM.
- An Entity cannot be a Market Participant in the ERERA regulated REM without being a Participant in the NRA regulated National Electricity Market (NEM), but an Entity can be a Participant in the NRA regulated NEM without being a Participant in the ERERA regulated REM
- NRAs participate in the REM surveillance by reporting market participants who breach the RMR or any of the Regional Market Regulations

12.2 Cooperation between Regional System/Market Operator and National Transmission System/Market Operators

The areas of cooperation between the SMO and the Domestic Transmission System Operators (DTSOs), regarding the Regional Electricity Market Surveillance are as follows:

i. Reporting

- The SMO has a reporting relationship with the DTSOs with respect to monitoring Market Participants' compliance with the provisions of the RMR
- The Control Areas (CAs) and the DTSOs must report to the SMO periodically on the performance of the electricity market within their Areas.

Market Monitoring Reports provide both descriptive market information, as well as screens for conducts. Descriptive information in the market reports includes general market conditions such as load levels, price levels, transmission congestion, resource commitment levels, scheduling patterns and operator actions. Screens for market conducts are meant to allow for quick identification of issues that may warrant investigation

ii. Investigation

The DTSOs must cooperate with SMO investigations, including providing information and records and allowing access to equipment and premises of participants, like the substation equipment under the care of the DTSOs, as may be requested.

iii. Outage Restoration

Control Areas and DTSOs must cooperate with the SMO restoration procedures and directions in case emergency

iv. Communication

- DTSOs must maintain the required communication with SMO
- The DTSOs must ensure the flows, technical parameters, operations in the interconnectors, planning and information are managed as the SMO may require

12.3 Obligations of Entities involved in Market Surveillance

Some of the obligations of the Entities involved in the Regional Electricity Market Surveillance are:

12.3.1. ECOWAS Regional Electricity Regulatory Authority (ERERA)

The ERERA obligations in the REM include:

- Receives reports from the SMO, Control Areas, Domestic TSOs and Market Participants on market breaches by any stakeholder
- Carries out investigations on breaches reported to it, especially the non-operational breaches
- Issues warnings and penalty notices to stakeholders for breaches of the regulation
- Carries out Dispute Resolution in line with the Dispute Resolution Procedures

12.3.2 National Regulatory Authorities

- Receive reports from Domestic TSOs, MO and other participants on market breaches by any stakeholder
- Carry out investigations on breaches reported to it
- Notify ERERA where the results of such investigations may have an impact on activities of the Regional Market
- Collaborate with ERERA with regards to sanction and enforcement proceedings on breaches affecting the regional market
- Recommend changes in Market Structure or in the Market Rules and Procedures that would improve the efficiency of the regional electricity market

12.3.3. The System and Market Operator

The obligations of the SMO in the Regional Electricity Market Surveillance are as follows:

- Receives complaints from market participants and market service providers, on breaches of the Market Regulations, as well as collects data for investigation and analysis
- Produces Rules Report on the implementation of the Market Rules and on the performance of the electricity market, including issues of breaches of the Market Regulations, and submits to ERERA
- Carries out investigations on breaches, including analysis of the market data
- Issues warnings and penalty notices to Participants for breaches of the Regulations
- Collects penalty payments from Participants for breaches

12.3.4. The Control Areas (CAs)

The obligations of the Control Areas in Market Surveillance are as follows:

- Reports participants' breaches to the SMO or to ERERA
- Cooperates with the SMO in cases of investigation

12.3.5. The Domestic Transmission System Operators (DTSOs)

The obligations of the Domestic TSOs in Market Surveillance are:

- Reports participants' breaches to the CAs, the SMO or to ERERA
- Cooperates with the SMO in cases of investigation

Table12.1: Summary of Obligations

s/n	Surveillance Activity	Stakeholder	Obligations regarding Surveillance Activity
1	Reporting	SMO	• Develops the market monitoring procedures and submits to ERERA for approval, for the purpose of establishing the mechanism by which the SMO shall verify that all participants comply with the RMR and Market Procedures • Reports to ERERA annually on market performance, including financial performance. Provides the same report to the Market Participants, NRAs • Reports to ERERA annually on the Participants', DTSOs', Control Areas' compliance with the RMR and Market Procedures • Publishes the annual Market Auditors report • Prepares and submits every six months, to ERERA, DTSOs, CAs and the Market Participants, the Rules Report on the implementation and application of the RMR • Maintains a Compliance Register where it will record breaches and potential breaches of the RMR and Market Procedures, identified through its own monitoring activities or notified by any market stakeholder
		Domestic TSOs	• Reports to ERERA on the violation of the RMR or Market Procedures by the SMO, CAs or any Market Participant
		Control Areas	• Reports to ERERA on the violation of the RMR or Market Procedures by the SMO, DTSOs, or any Market Participant
		Market Participants	• Reports to ERERA on the violation of the RMR or Market Procedures by the SMO, DTSOs, CAs or any Market Participant
2	Investigation	ERERA	Investigates any alleged Serious Breach, upon becoming aware of it
		NRAs	Investigates any alleged Serious Breach, upon becoming aware of it & notify ERERA in cases of breaches of REM

		SMO	Investigates any alleged Minor or Significant Breach upon becoming aware of it
		Domestic TSOs	Cooperates with the SMO in cases of investigation
		Control Areas	Cooperates with the SMO in cases of investigation
3	Issuing of Warnings	ERERA	Issue Warnings to the Market Participants, SMO, DTSOs or CAs on non-operational breaches
		NRAs	Refers breaches to ERERA for issuance of warnings
		SMO	Issue Warnings to the Market Participants, where it reasonably believes that non-compliant behavior has taken place
4	Sanctions	ERERA	Impose Sanctions on non-operational breaches
		NRA	Refers breaches to ERERA for imposition of sanctions and Imposes sanction where breach involves breach of license conditions
		SMO	Issue Warnings or Operational Penalty notice to any Market Participant for an Operational Breach. Operational Breaches are Minor or Significant Breaches that are related to the direct operation of the Regional Market for which ERERA has delegated the SMO the duty to investigate and impose operational penalties
5	Information Gathering	SMO	Gather information on Market Participants' behavior to substantiate allegations of non-compliance with the RMR or Market Procedures
6	Recommending Remedial Actions	SMO	Recommend changes in the Market Structure or the Market Rules and Procedures, that would improve the efficiency of the electricity market

13.Enforcement in Market Surveillance

Market Monitoring, in most cases is an ex-post exercise. The NRAs address market abuses through after the fact investigation. Where there are suspected cases of violation or breaches, these are referred to the SMO and ERERA for investigation and enforcement. The general Compliance Enforcement tools include compliance audits, investigations, spot checks, and other procedures for identification of breaches and assessment of penalties for noncompliance.

13.1. Types of Breaches

In accordance with ECOWAS Regulation on Sanctions, breaches to the ECOWAS Regional Electricity Market Regulations are classified by ERERA as a) Serious, b) Significant or c) Minor. The Serious breaches are also referred to as non-operational breaches and are those breaches which only ERERA can investigate into and impose sanctions on.

The Significant and Minor breaches are jointly referred to as operational breaches that are related to direct operation of the Regional Electricity Market, and for which ERERA has delegated the SMO, by a provision of the Market Procedures, the duty to investigate and impose operational penalties.

13.2 Investigation of Alleged Breaches

13.2.1. Investigation by the SMO

The SMO shall adopt the following processes to investigate any alleged Minor or Significant Breach of the RMR or Market Procedures:

i. On becoming aware of any breach through any of the relevant avenues, the SMO shall carry out the necessary investigation
ii. Where the SMO considers that the alleged Breach notified by a market participant on its own activities or those of other participant or service provider, relates to a matter already under investigation, or a matter that has already been investigated or a matter that the SMO has already concluded, there may not be any need for the SMO to initiate a reinvestigation on the matter
iii. In conducting investigation, the SMO has the authority to request for additional information or records from the participant, as well as to search the participant's premises and inspect its facilities, in line with the stipulated procedures
iv. The participant is expected to cooperate with the SMO in carrying out the investigation. But where the participant does not cooperate, the SMO will refer the investigation to ERERA
v. At the conclusion of the investigation, the SMO will record in its Compliance Monitoring Register, whether a Breach of the Rules or Procedures, has been committed, given all the evidence available

13.2.2. Investigation by ERERA

For investigations by ERERA, regarding the Serious Breaches or in those Breaches which the SMO could not conclude due to lack of cooperation from the Participant being investigated, the processes adopted by the SMO in carrying out investigations regarding the Significant and Minor Breaches, shall also be adopted by ERERA in conducting the investigations. This is however, subject to ERERA's Enforcement Rules.

13.3 Sanctions and Penalties

In line with the Regulation on Sanctions, ERERA shall apply sanctions against the Market Participant or Market Service Provider, in the case of breaches of the RMR or Market Procedures, or any other Market Regulation. Following this regulation, Sanctions for Serious Breaches or Non-operational Breaches shall be applied by ERERA, while sanctions for the Significant and Minor Breaches (operational breaches) shall be applied by the SMO where ERERA has delegated such powers to the SMO.

13.3.1. Sanctions and Penalties by the SMO

i. For the Operational Breaches, the SMO can, depending on the circumstances, issue a Warning or an Operational Penalty Notice to the Market Participant for the Operational Breach, in line with the RMR and Market Procedures. The SMO shall also file a complaint with ERERA relating to the breach

ii. In deciding that an Operational Breach has occurred, the SMO will take into account the results of its investigation, as well as the Market Participant's response to the SMO's warning, if any

iii. A Market Participant issued with a Penalty Notice may seek review of the SMO's decision by ERERA, in accordance with the RMR,

iv. The Participant must pay the penalty to the SMO within 28 days of receiving the notice.

v. ERERA shall determine the modality for the use of the operational penalty revenue

13.3.2. Sanctions and Penalties by ERERA

The decisions regarding the Serious or Non-operational Breaches can only be made by ERERA. In making the decisions, ERERA will follow the procedures laid out in the Regulation on Sanctions. ERERA may take a number of actions which include:

- Request additional information and data from the market participants
- Organize regular and extraordinary audits
- Prescribe corrective measures
- Prescribe sanctions, including financial penalties
- Temporarily or permanently take over licenses from market participants

13.4 Appeals of ERERA's Decisions in Regional Electricity Market Surveillance

Decisions taken by ERERA with regards to its enforcement powers under its Operations Regulations and Market Rules are deemed final and binding on Market Participants. Decisions of ERERA may however be challenged only on issues of law in the ECOWAS Court of Justice.