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List of abbreviations

BESS	Battery Energy Storage System
ECOWAS	Economic Community of West African States
ERERA	ECOWAS Regional Electricity Regulatory Authority
MW	Megawatt
MWh	Megawatt hour
PPA	Power Purchase Agreement
SMO	System and Market Operator
TORs	Terms of Reference
WAPP	West African Power Pool
WP2	Work Package 2



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1 Document Overview

The Work Package 2 (WP2) of the Terms of Reference (TOR) of this consultancy has the objective proposing a regulatory and institutional framework for the deployment of utility-scale Battery Energy Storage Systems in the interconnected network of the West African Power Pool system.

A Due Diligence Report has already been submitted in which a benchmarking analysis has been included as well as a due diligence analysing the gaps and challenges existing in the ECOWAS Regional Legislation and in each one of the national legislation in force in the ECOWAS mainland countries operates. The legislation that ECOWAS member countries must adopt to encourage the deployment of Battery Energy Storage System (BESS) has also been detailed in the mentioned report.

Chapter 2 of this report details the content of the draft Battery Energy Storage Systems Rules, including an explanation of the regulatory and institutional framework involved by the draft BESS Rules, of the contractual, pricing and technical aspects and it also contains a detailed explanation of the articles of this draft regional legislation.

Chapter 3 contains the draft BESS Rules.

Draft Legal Framework. The draft BESS Rules attached to this report that is reviewed and adopted by the Ministries in charge of energy, regulators and WAPP member utilities and should be formally reviewed and approved by a Resolution of ECOWAS Regional Electricity Regulatory Authority (ERERA) which, pursuant to article 17 of the Regulation 27/12/07 on the Composition, Organisation, Functions and Operation of ERERA has power to enact, set and specify technical and commercial rules on cross-border power pooling, through the transmission network, between ECOWAS Member States. Moreover, pursuant to article 16.3 a) and 17 of the mentioned Regulation, ERERA has the mission of establishing the technical regulations and more specifically conditions for access to the interconnected transmission network, entry of operators into the market.



2 Proposed Regulatory and Institutional Frameworks

2.1 Introduction

As it was mentioned in the Due Diligence Report of Work package 2 (WP2), the expansion of renewable generation globally observed has been one of the energy sector's greatest successes over the last decade. However, it created the challenge of maintaining efficient and effective power grids by properly integrating intermittent renewable energy sources, such as solar and wind. This situation makes necessary the use of sources of flexibility.

The use of storage in networks is not new, such as pump hydro, but in recent years Battery Energy Storage Systems (BESS) emerged as a key source of flexibility to integrate variable renewable generation.

BESS may play a role in any market, including the wholesale and balancing markets, as well as provide a wide range of services to the transmission and distribution grids in order to ensure efficient, stable and reliable network operation.

BESS may be used to address several challenges related to the large-scale integration of variable renewable generation for the following reasons¹:

- BESS are better suited to frequency regulation than traditional spinning reserve power plants since for instance BESS can provide regulating power with sub-second response times;²
- BESS provide a cost-effective alternative to transmission and distribution network expansion for reducing curtailment of solar and wind power generation. At the same time, batteries allow consumers to avoid peak charge by supplying off-grid energy during on-grid peak hours;³

¹ Handbook on Battery Energy Storage System, December 2018, Asian Development Bank

² Ibid.

³ Ibid.



- As intermittent renewable generation often does not coincide with electricity demand, the surplus power may be subject to curtailment (unless exported). In this context, BESS allow the storage of surplus power to be consumed later when renewable power generation is low and electricity demand increases.⁴

As the absence of an adequate legal framework may create an obstacle to the financing and deployment of BESS, the proposed regional legislation establishes the regulatory requirements for the participation of BESS in the Regional Electricity Market.

The draft Battery Energy Storage Systems Rules are explained at the end of this chapter.

2.2 Regulatory Framework

The applications of utility-scale BESS may be multidimensional and involve various stakeholders.

BESS may inject or withdraw electricity in an electricity market and may also provide different grid services, some of which are below detailed in table 1. Therefore, BESS may provide different services in any energy, capacity and ancillary services markets, national or regional.

BESS can have different applications, from short-term balancing of supply and demand, to restoring grid operation following a blackout, or deferring investment in new transmission and distribution lines.

⁴ Ibid.



Table 1: Applications of Utility-Scale Energy Storage ⁵

Application		Description	Duration of Service Provision
Arbitrage		Purchasing low-cost off-peak energy and selling it during periods of high prices	Hours
Firm Capacity		Provide reliable capacity to meet peak system demand.	4+ hours
Operating Reserves	Primary Frequency Response	Very fast response to unpredictable variations in demand and generation	Seconds
	Regulation	Fast response to random, unpredictable variations in demand and generation	15 minutes to 1 hour
	Contingency Spinning	Fast response to a contingency such as a generator failure	30 minutes to 2 hours
	Replacement / Supplemental	Units brought online to replace spinning units	Hours
	Ramping/Load Following	Follow longer term (hourly) changes in electricity demand	30 minutes to hours
Transmission and Distribution Replacement and Deferral		Reduce loading on transmission and distribution systems during	Hours

⁵ Source: Grid-Scale Battery Storage, Frequently Asked Questions, Greeing the Grid, USAID, NREL Retrieved from <https://www.nrel.gov/docs/fy19osti/74426.pdf>



Application	Description	Duration of Service Provision
Black Start	Units brought online to start system after a system-wide failure (blackout)	Hours

Various governments adopted energy storage system policies to foster the integration of renewable energy and reduce greenhouse gas emissions. Some of the countries and regions were important amounts of BESS already deployed adopted policies that were detailed in the benchmarking analysis included in the Due Diligence Report of Work Package 2 (WP2).

BESS may be located in the transmission network, in the distribution network near load centres or co-located with intermittent renewable generation.

BESS enables power system operators, utilities, developers or consumers to store energy for later use.

It is necessary to repeat in this report the different alternatives of business models of BESS that exist internationally since this matter is mentioned in the draft BESS Rules.

Internationally, there are several business models depending on how ownership and operations responsibility is divided between the utilities or network operator, consumers and providers of BESS:

- 1) Centralised systems: The deployment of BESS as stand-alone facilities may be developed and operated by private operators. This alternative is named “centralised system” by the Terms of Reference (TORs) of this consultancy. As it was mentioned in the Due Diligence Report of WP2, preferably, the legal frameworks should define who may not own BESS. In this regard, there are different alternatives since the deployment of BESS may be done by:
 - (a) private operator: private operators of BESS may be based on a free market or on a public tendering; or



- (b) transmission or distribution network operators. This option is not permitted by certain legal frameworks, for instance in the European Union, the United Kingdom or Germany. However, it is allowed in California.
- 2) Decentralised systems, identified by the TORs as the development of renewable energy projects co-located with utility-scale BESS (also known as hybrid projects). Increasingly, batteries are being combined with generation plant such as solar photovoltaic, onshore wind and offshore wind. “For intermittent renewable generation, the addition of storage may allow variable output to be smoothed, imbalance costs to be reduced and new revenue sources to be accessed”.⁶ The battery array may be owned by the same vehicle or may be subject to separate contractual arrangements and have its own independent revenue sources.⁷
 - 3) Behind the meter option: under this alternative, the BESS is sited on customer premises and the storage system is connected to the distribution system on the customer’s side of the utility’s service meter. Customer may not only use BESS for own application, such as arbitrage of the specific customer, but it may also be centrally coordinated (by aggregators) to offer different services to the grid, such as balancing and peak shaving.
 - 4) Microgrids: this model refers to very small power networks that can operate independently. They have traditionally been used in industry and more recently microgrids using renewable energy generation have been increasingly used to power remote communities.⁸ In non-interconnected grids or island grids, batteries are combined with fossil fuelled or renewable generation. For example, some Hawaiian Islands require renewable generators to couple any new generation facility with batteries to help manage the local grid. And in emerging markets, small and off-grid solutions with battery storage is a sustainable option to the traditional centralised generation model.⁹

⁶ Ibid.

⁷ Ibid.

⁸ Handbook on Battery Energy Storage System, December 2018, Asian Development Bank

⁹ Financing Battery Storage + Renewable Energy, Norton Rose Fulbright, January 2018, retrieved from <https://www.nortonrosefulbright.com/en/knowledge/publications/be9b81a5/financing-battery-storage-renewable-energy>



5) Customer-sited, off-grid battery storage systems, which are not connected to the grid.

The Terms of Reference of this consultancy is linked to the “elaboration of a regulatory and institutional framework for the deployment of utility-scale BESS in the interconnected grid of WAPP. Therefore, the draft BESS Rules are focused on grid-scale BESS in this grid, including front-the-meter and behind-the-meter storage, while the last two options before mentioned (microgrids and customer-sited off grid) are excluded from the application of the draft Rules.

The scope of the draft BESS Rules is to establish a legal framework applicable to all alternatives of grid-scale BESS of the WAPP grid including the centralised and decentralised options as well as the Behind-the-Meter option. This framework is meant to be applicable also in the long term.

The international benchmarking included in the Due Diligence Report of WP 2 mentioned that there are three different categories of policy and legal reform, as the examples mentioned in this report show, as follows:¹⁰

- 1) Basic reforms that enable private energy storage developers to reasonably enter the local energy market. These countries allow storage developers to compete in the market but leaving those developers exposed to market risks and responsible for establishing the business model based on market mechanism.
- 2) Reforms to introduce incentives to encourage the development of the energy storage market by strengthening the business case; and
- 3) Reforms containing direct subsidisation and support (such as grants, targeted mandates, tax benefits, etc.).

Category (1) of reform involves the reform of wholesale market. The last two categories of reform increase the security of investors.

Category (1) of reforms analysed in the benchmarking analysis of the Due Diligence Report showed that the following rules were included:

- a) Reform of the wholesale electricity market to allow energy storage projects, including grid-scale and behind-the meter installations providing demand-side response, to participate and earn revenue without discrimination and regardless of the technology under competitive basis.
- b) Definition of energy storage in the legal framework or at least ensure that storage projects are treated separately to generation assets.

¹⁰ Ibid.



- c) Definition of who may or may not own BESS. For instance, in the EU, the UK or Germany, transmission and distribution system operators are not allowed to own BESS, while in the US and in California system operators may own and operate BESS. This may be considered as blocking transmission and distribution deferral, an important application of BESS.¹¹
- d) Elimination of legislation that require BESS owners to pay twice fees or tariffs, that is, when they draw power from the grid as well as inject power into it.

Category (2) reforms include the following direct subsidisation and support, including the following:

- a) Measures that facilitate long-term contracts between energy storage owners and parties responsible for balancing or system operators to increase revenue certainty. In countries that implemented category (1) reforms and allowed BESS to compete in the market the contracts are relatively short-term, which is generally one to five years depending on the application and country. “In addition, the procurement of ancillary services, particularly services not related to balancing, is often not market-based.”¹² For instance, in Germany, the Federal Network Agency conducted the first three rounds of the so-called “innovation auctions” in 2020 and 2021 for the integration of large solar and wind energy that can bid in combination with battery storage systems.
- b) Measures that ensure value on grid flexibility and contributions of electricity storage (including BESS) to system adequacy and decarbonisation in order to provide signals for investment. For instance, in the United States, in 2011 the Federal Energy Regulatory Commission (FERC) issued Order 755 that required system operators_“to add a performance payment with an accuracy adjustment to the capacity payment typically used in ancillary services”. On frequency regulation, this order required independent system operators and regional transmission organisations markets to compensate for resources that can provide faster-ramping frequency regulation.

As detailed in the international benchmarking contained in the Due Diligence Report of WP2, the United States, California and Germany implemented different schemes of support of targeted BESS projects. For instance, California Assembly Bill 2514 was the first state law in the United States establishing a mandate for energy storage systems. It obliged the local regulator California Public Utilities Commission (CPUC) to require California’s investor-owned utilities to procure 1.3

¹¹ Ibid.

¹² Ibid.



GW of storage capacity by 2020, split among the transmission, distribution, and customer domains. The 1.3 GW storage goal was intended to be split evenly among the three investor-owned utilities.

It must be noted that the draft Battery Energy Storage System Rules contained in this report, if adopted, would establish a legal framework for allowing and ruling the participation of Battery Energy Storage System in the Regional Electricity Market.

This draft Rules intend to introduce a “basic reform”, that is, it involves a reform that enables private energy storage developers who operate BESS to participate in the Regional Electricity Market under competitive conditions.

It is noted that a fully competitive Regional Electricity Market will exist in its third phase of development. In this regard, there are three phases contemplated in the Regional Market Rules for the WAPP approved by Resolution N° 005/ERERA/15 establishes, the Regional Electricity Market (article 12).

Currently, the Regional Electricity Market is in Phase 1. During this phase, trading is carried out on a “case by case” basis, and the regional market is a bilateral market where bilateral agreements are used for trading.

During Phase 2 there should be short-term exchanges carried out through a day-ahead market.

During Phase 3 the following will occur:

- A liquid and competitive regional market exist, and it is possible by the availability of enough regional transmission capacity and enough reserve in the countries.
- Trading different products integrating other markets: market for some ancillary services and financial products.

As explained in the Due Diligence Report of WP 2, internationally, the deployment of on-grid BESS as stand-alone facilities has been mainly financed in the market and particularly through the provision of ancillary services in competitive markets.



In the ECOWAS region, the establishment of a competitive regional market for some ancillary services seems feasible only during the third and last phase of the market, which is foreseen in the long or very long term if a payment mechanism is rolled out to encourage it.

Therefore, the financing of BESS in the grid as stand-alone facilities (decentralised systems) by means of a competitive electricity regional market can only be foreseen in the long or very long term, provided that a competitive market is developed and includes auxiliary services.

Another alternative to finance the deployment of batteries is through some kind of subsidisation. But this is not imposed by the draft regional BESS Rules. However, it is an alternative that ECOWAS countries may implement.

A simple option for the development of BESS as stand-alone facilities or co-located with renewable energy projects in countries where the WAPP and ECREEE develops projects is to launch competitive tenders for their establishment.

Moreover, the draft BESS Rules not only allows the participation of operators of BESS but also of persons engaged in aggregation.

As trades in electricity markets in general involve greater capacities than, for example, a household or an owner of electric cars could offer, there is a need to pool capacity from these flexible units. The aggregator's function is to pool electricity supply and/or demand and sell this capacity in the electricity markets. Thus, aggregators should be allowed to combine multiple customer loads or generated electricity for sale, purchase or auction in any electricity market.

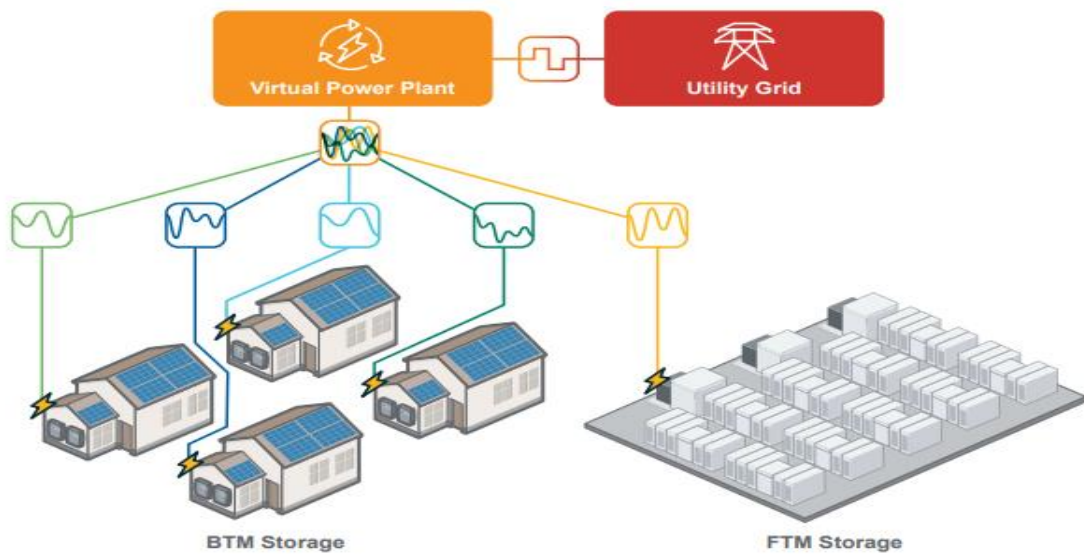


Figure 1: Illustrative example of virtual power plant aggregation

This regional draft BESS Rules also requires that countries where the WAPP operates adopt certain legal and regulatory measures. For instance, the draft Rules, obliges operators of BESS and aggregators who intend to participate in the Regional Electricity Market to have previously obtained a licence or any other kind of authorisation that allows them to operate in one of the ECOWAS countries, and to comply with the national grid code to connect to the local electricity grid.

2.3 Contractual Aspects

2.3.1 Dedicated statute for Energy Storage

The definitions contained in another article defines energy storage and Battery Energy Storage Systems (BESS) to avoid uncertainty and differentiate energy storage from other activities as generation or consumption.

The international benchmarking included in the Due Diligence Report of WP2 that analysed different legislation reforms introduced in countries where important amount of BESS have been deployed concluded that it is necessary to grant a differentiated statute to energy storage differentiating it from generation and from consumption. It also identified a minimum of provisions related to BESS that must be contained in the legislation.



Therefore, the draft BESS Rules:

- (a) contains a general explanation of the general role of energy storage systems in electricity markets, with an emphasis of the role of BESS; and
- (b) defines energy storage, batteries and battery energy storage system, and contains several rules applicable to BESS, detailed in other title of this report.

2.3.2 Market entry requirement: licence or authorisation

As other market participants that carries out activities in the electricity sector, the legislation should define the market entry requirements applicable to operators of BESS and aggregators that allow them to perform energy storage and participate in the national electricity market.

Thus, the local legislation may oblige BESS operators to obtain a licence to be allowed to perform energy storage activity and to participate in the national electricity market.

The draft BESS Rules expressly indicate that operators of BESS and aggregators that apply as market participants of the regional electricity market must have obtained the licence or any other kind of authorisation to perform energy storage activity in the country where they are located. A similar requirement is applicable now to generators and grid operators who participate in the regional electricity market.

The type of authorisation that is necessary for the operation of BESS is determined by the legislation of each country, and such legal document may be a licence or another legal document. The licence may, in some cases involve a more complex contractual system than a simple authorisation, and even may require a prior call for tenders, but this is not always the case. A simple authorisation is a more agile system that is generally required for small auto-generation plants. But there are no uniform rules, it all depends on the country's legislation.



2.3.3 Service contract

As the draft Rules recognise, there are different services that may be provided by BESS in any electricity market (energy, capacity and ancillary services markets):

“The deployment of Battery Energy Storage Systems as stand-alone facilities may be used to provide different applications such as peaking capacity (BESS are used to meet demand during peak periods), Reserves (Primary Reserve or Frequency Containment Reserve, Spinning Reserve, etc.), transmission and distribution replacement and deferral, and Black Start.”

When the BESS is co-located with a solar generation project, the batteries charge energy from the solar system and may provide back-up electricity when there is no or low sunlight. In this case, the BESS improves the integration of intermittent renewable energy production projects. In large installations of BESS, certain grid services may be provided by the storage installation as well.

When BESS are located on the customer premises (Behind-the-Meter), BESS allow customers to use Battery Energy Storage Systems for own application such as arbitrage (shifting electricity consumption from high to low energy cost periods), provide reliable access to power after a disruption to the grid (mainly if those disruptions or interruption in supply occur frequently), protect the customer against short-duration events that affect the quality of the power delivered to the customers, etc. Behind-the-meter Battery Energy Storage Systems may also be centrally coordinated, through aggregators, to offer different services to the grid. Aggregation is the process of combining multiple small assets to act as a larger asset for the provision of specific services to the power system.

Any of the mentioned services may be provided by BESS in competitive energy, capacity and ancillary services markets.

At national level, the different services that the BESS may provide are agreed between the operator of BESS or aggregator and the local market and/or system operator responsible for, for instance, ruling a day-ahead market or an ancillary service market.

At regional level, the Regional Market Rules, which must be reviewed before the initiation of Phase 2 of the regional market, must determine the role of the System and Market Operator in procuring the services that BESS operators and aggregators may provide in any electricity market.



2.3.4 Power Purchase Agreement (PPA)

In countries where there are no competitive electricity markets in which the BESS operators may participate under competitive basis, local authorities may decide other means to promote the deployment of BESS. One alternative is to launch a competitive tender for the establishment of BESS, either as stand-alone facilities or co-located with renewable energy generation projects.

In those cases, typically a power purchase agreement (PPA) defines the services to be provided by the BESS.

If the BESS is co-located with a renewable generation installation, both installations may be treated as a single entity or treated as two separate projects. If the PPA covers both installations, the BESS is considered as part of the overall generation unit. Large solar projects with BESS may sometimes determine in the PPA the provision of additional products to the system, such as renewable energy credits or certain ancillary services.

If in the BESS co-located with renewable generation project are treated like two different projects, the PPA related to the BESS must determine the products that will be provided from the BESS and how they will be measured and paid.

2.3.5 Duration.

The duration of any PPA related to a BESS project may be linked to the end of the useful life of the batteries. However, as batteries may be replaced, the term of the PPA may last longer periods. This last alternative has a drawback: the technology advances and the prices of BESS have declined over time and that trend might continue. Thus, long-term contracts do not benefit from such drop of prices over time. In the case of a single PPA for both a renewable energy generation project co-located with BESS may require differentiated terms for various products and services.

In all cases, at the end of the useful life of BESS, those storage devices must be discarded or recycled in accordance with the requirements established in environmental legislation in force.



2.4 Institutional Framework

The draft BESS Rules involve differentiated roles between the entities involved.

2.4.1 Regional Institutions and Stakeholders

(a) System and Market Operator (SMO).

The regional System and Market Operator (SMO) receives the applications of operators of BESS and aggregators who intend to become market participants in the regional electricity market and decides their admission as market participants. The SMO controls the compliance of those applicants with the requirements of regional legislation, and maintains and updates the register of market participants.

Pursuant to Sections 8.05 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17, the SMO determine a schedule of one-off application fees, approved by ERERA, to be charged to the applicants.

The Regional Market Rules shall be reviewed before the initiation of Phase 2, which will define the role of the SMO in the Day-Ahead Market that will exist in this Phase. The reviewed Regional Market Rules will also define the roles of the SMO in Phase 3, in particular in procuring services in the Ancillary Service Market.

(b) ERERA

The Regional Electricity Regulatory Authority (ERERA) acts as regional regulator and as such: performs technical regulation, regulate cross-border power pooling among countries, oversee the regional market, monitor and enforce compliance of regional legislation and resolves disputes between the market participants or between them and the SMO. Any market participant of the Regional Electricity Market is subject to the regulation of ERERA.

ERERA must also formally approve, by Resolution (after a long procedure of review) the draft Rules on BESS.

(c) WAPP

The West African Power Pool (WAPP) was established by Decision A/DEC.5/12/99 with the intention of addressing power supply deficiency within the West African sub-region.

According to the Operation Manual for WAPP adopted by Resolution N° 007/ERERA/15 the WAPP is opened to any public or private entity that own/operate generation facilities of 20 MW or larger, and/or distribute and retail supply electricity (the “Transmission Using Members”); and/or



(b) own/operate major transmission facilities in the region. The Operation Manual does not contemplate yet the participation of BESS installations yet and that is why an amendment to such resolution is included in the draft Rules on BESS.

2.4.2 National Institutions and Stakeholders

The local authorities and stakeholders, in particular national system and market operators, have several roles below detailed.

As it was mentioned in the Due Diligence Report of WP2, the lack of an adequate legal framework constitutes an obstacle to the financing and deployment of energy storage systems. Therefore, the modification of the national legislation was recommended in order to include a “basic reform” that allows the participation of BESS in the local energy market as a differentiated activities with own rules. That involves the following:

- 1) Electricity storage should be defined in the national legislation and differentiated from the electricity generator or consumer. If, on the other hand, the legislation assimilates him to an electricity consumer, it is important to avoid the double imposition of tariffs and taxes (when drawing electricity from the network and when injecting it) because this constitutes an obstacle to the development of energy storage systems.
- 2) The legal framework must establish the persons who may and may not operate BESS in the national electricity market (in particular if any limitation is applicable to grid operators).



- 3) The legislation should preferably authorise BESS operators and aggregators to participate in any energy, capacity and ancillary service markets that exist or may exist in the future at national level. In this regard, it has been highlighted that if this matter is not expressly defined in the legislation, some grid operators may be reluctant to procure those services from BESS operators and aggregators, and thus, the project financing of BESS is put at risk.

Secondly, the national authorities must adopt the legislation (preferably la loi) establishing the requirements for market entry of operators of BESS and aggregators, such as a licensing or an authorisation requirement. That is required by the draft BESS Rules as a condition to apply a market participant of the regional electricity market.

Thirdly, if there are no competitive electricity markets (such as wholesale energy and ancillary services markets) in which the BESS operators may participate under competitive basis, local authorities may decide other means to promote the deployment of BESS. Some of them were mentioned in the benchmarking analysis included in the Due Diligence Report of WP 2, such as:

- Establishment of a specific target of BESS that certain market operators must deploy (California example);
- Establish a specific target of BESS that grid operators must procure from the electricity market under competitive basis (California model).
- Launch a competitive tender for the establishment of BESS, either as stand-alone facilities or co-located with renewable energy generation projects.

If a tender is launched for the procurement of BESS, either as stand-alone facilities or co-located with a renewable energy generation project, the national authorities or the grid operator should be involved in the tender process. The local legislation on procurement is applicable. Typically, a power purchase agreement (PPA) should define the ways in which BESS will be used and the services that it will provide.

The local authorities should also review the legislation in force to identify whether or not it obliges BESS owners to pay twice transmission fees, taxes or tariffs, that is, when they draw power from the grid as well as inject power into it. Double imposition of fees, taxes and charges constitute a major obstacle for the deployment and financing of BESS.



Finally, the legislation in force in the countries where the BESS would be located will also be applicable to the BESS project. In this regard, for instance, the BESS project should comply with the national Grid Code and technical rules to connect and use the national grid. Any other applicable technical or environmental legislation in force should also be complied by the BESS operator. The local authorities and stakeholders should verify the compliance of any technical, safety or environmental legislation applicable in the country where the BESS is located.

(a) Parliament

An amendment to the act ruling the electricity sector will be necessary to implement what was described as a “basic reform” to allow the participation of BESS operators and Aggregators in the national electricity market. In particular, this is necessary to include in the legislation the definition of energy storage and the corresponding licensing or authorisation requirements. The Parliament is involved in the enactment of any amendment to the act ruling the electricity sector.

(b) Ministries and Regulators

The line ministry or the electricity regulator are usually responsible for:

- approving the regulations necessary for ruling the issuance of licences and authorisations. They must be reviewed to include licensing requirements to BESS operators and Aggregators.
- Issue licences and regulations
- Monitor compliance with / enforce applicable national regulation

If the country decides to deploy BESS before the establishment of a competitive market for ancillary services, the ministry, regulator or grid operator may be involved in the procurement procedure, such as in a competitive tender. The legislation defines which institution is responsible for such procurement.

(c) Grid Operator

The grid operator connects the installations of BESS Operators to its electricity grids. Previously, it controls the compliance of Grid Code and other applicable technical regulations, indicate the equipment that the BESS Operators must install, and signs an interconnection agreement.



The national grid operator must procure ancillary services in accordance with the national regulations, including from Operators of BESS and Aggregators.

(d) Operators of BESS and Aggregators:

They are the entities that are allowed by the draft BESS Rules to participate in the national and regional electricity market as market participants.

They must obtain a licence or other kind of authorisation, as required by the national law, to perform activities as operators of BESS or as Aggregators.

They must submit an application to the SMO and comply with all the applicable regional legislation, and be admitted as market participants by the SMO to be able to participate in the regional electricity market.

The aggregator's function is to pool electricity supply and/or demand and sell this capacity in the electricity markets. As the draft BESS Rules indicate “as trades in electricity markets in general involve greater capacities than, for example, a household or an owner of electric cars could offer, there is a need to pool capacity from these flexible units”, and thus “aggregators are allowed to combine multiple customer loads or generated electricity for sale, purchase or auction in the Regional Electricity Market.”

(e) Consumers:

Consumers who own BESS installed on their premises, may own BESS, but for own use (such as arbitration or uninterrupted supply of high-quality power). Additionally, those customers may be interested in granting other power system stakeholders access to their systems in exchange for payments.

(f) Environmental authorities:

Environmental authorities must monitor compliance of environmental legislation by operators of BESS.

2.5 Pricing

For BESS operators and aggregators bidding in WAPP, once a competitive Regional Electricity Market exists, there should be no restriction to market segments participation. In general, the pricing terms in WAPP will be the same as for other generation and demand participants. BESS operators and aggregators would therefore have access to the following pricing options:



- Energy Arbitrage: buying electricity at the wholesale regional market when prices are low and selling it when prices are high.
- Ancillary services: batteries can provide frequency regulation services by quickly injecting or absorbing power to stabilise grid frequency. Pricing for frequency regulation might be based on performance metrics such as response time, accuracy, and availability, with payments made for providing regulation capacity and for responding to frequency deviations.

Further to the pricing options mentioned above there are some additional mechanisms that can be considered at national level, where an electricity market exists. They include:

- Capacity Markets: Capacity markets provide payments to generators and storage providers for committing to provide a certain amount of power capacity during specified periods of scarcity. Pricing in capacity markets involves bidding for capacity contracts based on the availability and reliability of the storage system, with payments made for capacity commitments over a specified period.
- Demand Response Programmes: Batteries can participate in demand response programmes by curtailing or shifting their charging or discharging patterns in response to price signals or grid conditions. Pricing for demand response programmes varies based on the structure of the programme, with payments typically made for reducing electricity consumption or providing additional capacity during peak periods.

In general terms, if a tender is launched at a national level for the procurement of BESS, even where there is no domestic wholesale electricity market, the typical pricing schemes are defined within the power purchase agreement (PPA), together with the services that the BESS should provide (including energy shifting, congestion relief, firm capacity, voltage and frequency control, black start). PPAs come in many forms and variants, but their common pricing characteristics are:

- Capacity payments (fixed payments) associated with capital and fixed costs
- Variable payments, associated with variable costs (operation and maintenance, and losses associated with the charging cycle and, possibly, the valorisation of the avoided CO₂)
- Liquidated damages or Penalties paid by the asset owner when the services are not provided according to the conditions established in the PPA.



2.6 Technical aspects

Electricity from the BESS must be provided at the required system frequency and at the appropriate voltage for electrical interconnection with the network. The owner is responsible for:

- Gaining approval from the network operator for interconnection and any required upgrades;
- Providing all necessary BESS details for the interconnection applications, and funding any interconnection studies to be performed by or on behalf of the electric utility, where required;
- Providing a commissioning report documenting BESS performance during normal grid-tied operations and during grid failure, if applicable;
- All permits, approvals, environmental compliance, freight, procurement, monitoring, site inspection as necessary to design, construct, and interconnect the complete BESS, in compliance with local laws, regulations, codes and standards;
- Getting all installed equipment tested and approved by nationally recognized testing facility;
- Complying with certification requirements of batteries, enclosures, inverters, and other balance of system components according to the local legislation;
- Proper circuit sizing, overcurrent protection, and coordination of the circuit(s) beyond the point of interconnection to the network.

For utility scale projects, the central control of BESS power, including frequency control set points, is to be provided centrally, externally by the System National Dispatch Centre. The owner must adapt the corresponding interface and communication protocols as required. Thereby only one power signal shall be transmitted and the optimised distribution and control shall then be taken over by the internal BESS Master Control System and its subsystems. The return value (status) also consists only of a cumulative total power value.

Simultaneous Operation of frequency control and load shifting, or ramp control should be possible. Other types of applications that require power control, such as load shifting or ramp control, should be executed via the external setpoints from the Dispatch Centre. For simultaneous operation, the operating point is set via the setpoints (external). The frequency control should operate automatically in the specified ranges.

Important BESS system aspects that should be considered during the procurement include:



- the “C-rate”, which is the amount of electrical current (Amperes) that would completely discharge a fully charged battery in one hour. For a 15-minute frequency reserves use case requirement, the C- rate is 4. For a 4-hour time-shifting use case the C-rate is $\frac{1}{4}$. The lower the C-rate, the less severe the duty imposed on the battery.
- The State of Charge, which typically depends on the use case(s) for a BESS. For the frequency reserves use case, the average daily State of Charge is approximately 50% in that the BESS returns to that level after each, relatively infrequent, call for reserves. For a time-shifting use case, the average daily State of Charge could be 33%, considering the charging, holding, and discharging sequence of daily cycles.

The Depth of Discharge, which is measured in per cent and is specified by battery cell manufacturers at the time of procurement. For Lithium-Iron-Phosphate batteries, for example, the highest State of Charge is 90% and the lowest is 10%, yielding a Depth of Discharge of 80%. Normally, operating outside the Depth of Discharge limits would invalidate the warranty from the suppliers.

Each one of these system aspects has an impact on the design and use of a BESS system:

- The C-rate influences the type of cell specified for the BESS: a power cell for frequency reserves (high C-rate); and an energy cell for time shifting (low C-rate).
- The Depth of Discharge determines the amount of actual storage capacity (MWh) relative to the nameplate storage capacity; for the 80% Depth of Discharge case, the actual capacity would be $1.0/0.8=1.25$. That is, 25% additional nameplate capacity is installed to meet Depth of Discharge requirements.
- The average State of Charge influences the rate of capacity fade. The higher the average State of Charge the faster the rate of capacity fades. Another factor that influences fade is the ambient environmental temperature of the cells in modules.

Regarding lifespan of stationary storage, one of the essential factors to take into account is cycle stability. The fuller cycles (one full charge and discharge) a battery storage system achieves, the higher its economic efficiency. In term of number of cycles Li-ion Lithium-Iron-Phosphate technology is the leader, with cycles of up to 10,000. However, manufacturers only give an average performance guarantee of 10 years with a daily full cycle, which corresponds to approx. 3000 - 4000 cycles/lifetime. The latest developments in Lithium-Iron-Phosphate technology show cycle stability of over 30,000 under laboratory conditions, and this number is rising, which should lead to increases in the duration of performance guarantee that might be required in the future.



With respect to monitoring and performance, BESS systems should have a Data Acquisition/monitoring/alarm system with:

- Full monitoring of electrical power and related operational data, including voltage, current, and system temperature;
- Visual and audible alarm if potential safety hazard exists;
- Notification when preventive maintenance is needed;
- System level alerts to be provided by the manufacturer over customer interface.

A decommissioning/disposal plan should also be included as part of operations and maintenance documentation, when the project is developed, demonstrating the ability to recycle or safe dispose all parts of the BESS.

2.7 Implementation. Challenges and Risks. Mitigation measures

The implementation of the identified BESS projects, in what concerns the legal and institutional conditions, requires the following:

- (a) Formal approval of the draft BESS Rules at regional level and identification of sources of financing.
- (b) Adoption of the national legislation in all ECOWAS countries: In what concerns the modification of the national legal frameworks, it is necessary that the countries adopt legislation establishing the market entry requirements (such as a licence or authorisation) that BESS operators or aggregators must comply with to perform energy storage and participate in the electricity market.
- (c) In addition, as it has been detailed in the Due Diligence Report of WP2, it is highly recommendable that these countries introduce the following amendments in their legislation:
 - (i) Definition of energy storage in the national legislation, as an activity different from generation and consumption. This definition should be in line with the one included in the regional BESS Rules.
 - (ii) Establishment of the market entry requirements applicable to operators of BESS and aggregators.
 - (iii) If the regulation in force causes that transmission and other fees, and taxes are charged twice to BESS operators, that is when drawing electricity from the network and when injecting it, the necessary measures to avoid such double imposition of taxes, charges and fees should be adopted.



- (iv) Identification of the persons who may and may not operate BESS in the national electricity market (in particular if any limitation is applicable to grid operators). This matter should be in line with the requirements established in the regional BESS Rules, otherwise those operators would not be allowed to participate in the regional electricity market.
- (v) The legislation should preferably authorise BESS operators and aggregators to participate in any energy, capacity and ancillary service markets that exist or may exist in the future at national level.

The main challenge for the deployment of BESS in the Regional Electricity Market is that it is in Phase 1, during which trading is carried out on a “case by case” basis, and the regional market is a bilateral market where bilateral agreements are used for trading. During Phase 2 there should be short-term exchanges carried out through a day-ahead market.

But it is not until Phase 3 when a liquid and competitive regional market and, in particular a market for some ancillary services and financial products will exist.

As explained in the Due Diligence Report of Work Package 2, internationally, the deployment of on-grid BESS as stand-alone facilities has been mainly financed in the market and particularly through the provision of ancillary services in competitive markets.

Therefore, the financing of BESS in the grid as stand-alone facilities by means of a competitive electricity regional market can only be foreseen in Phase 3 of the regional electricity market, that is in the long or very long term.

A mitigation measure for this barrier is that ECOWAS countries may adopt any kind of incentives for allowing the deployment of BESS in their territories. One of them could be the launch of a competitive tender for the establishment of BESS, either co-located with renewable generation projects or installed as stand-alone facilities.

As the Due Diligence Report of WP2 details, some ECOWAS countries informed that some BESS projects are ongoing or projected.

The financing of BESS projects through tenders may be done with own funds when that is possible. If there were no own funds, an attempt could be made to obtain grants from foreign governments or international organisations.



Another important challenge is the price of BESS, which increases the cost of the services that BESS may provide and which may not be competitive with other technologies (such as thermal generators).

However, international experience shows that the prices of BESS as well as of the services that they provide have declined in the last years. Moreover, the international experiences analysed in the benchmarking study of the Due Diligence Report of WP2 showed that BESS have been competitive in those countries. But the prices of the BESS technologies have tended to decrease over time, so the cost of the services that they provide tend to decline.

Another challenge for the deployment of BESS in the ECOWAS region is if ECOWAS member countries do not adopt the legislation establishing the market entry requirements (such as a licence or authorisation) that BESS operators or aggregators must comply with to perform energy storage and participate in the electricity market, those entities would not be allowed to apply as market participants in the regional electricity market. In this regard, the BESS Rules requires that applicants must have been licensed or authorised by the countries where they are located.

Moreover, another challenge is for ECOWAS member countries to adopt not only the aforementioned market entry requirements applicable to operators of BESS and aggregators, but also the other legal modifications recommended to encourage BESS deployment. They include a definition of energy storage in the legal framework, the elimination of double imposition of fees, charges and taxes to operators of BESS, the identification of persons who may and may not operate BESS, and the express authorisation that allows operators of BESS and aggregators to participate in any national electricity market (such as energy or ancillary services markets).

To deal with this problem, ERERA may play an important role of cooperation with the local authorities, ministries and regulators in advising and insisting on the legal amendments that must be introduced in the national legal frameworks.

In what concerns the deployment of BESS “behind-the-meter”, that is owned by consumers connected to the distribution system, as before mentioned, they may be used for the provision of reliable access to power, but also for arbitrage (shifting electricity consumption from high to low energy cost periods).

The current absence in most of countries of the ECOWAS region of differentiated time rates, such as the Time of Use tariffs (tariffs that use different prices to encourage consumers to use electricity at times when electricity at times when more is available cheaply) is a challenge for the



deployment of BESS behind-the-meter. The use of BESS for the provision of arbitrage is an incentive for the establishment of BESS behind-the-meter.

In this regard, it is recommended that national regulators begin to study the implementation of rates such as Time of Use, which differentiate the rate according to the time of consumption. This may bring the additional benefit of lowering the peak consumption.

2.8 Roadmap

The implementation at national and regional levels of the actions required for allowing the deployment of BESS are below detailed.

i. At national level:

- (i) In the short-term: In the short-term the following should be implemented:
 - (a) Amendment of the law ruling the electricity sector to establish the following:
 - Definition of energy storage.
 - Indication of persons who may and may not own BESS.
 - Market entry requirements (licence or authorisations) applicable to BESS operators and Aggregators.
 - Preferably explicitly authorise BESS operators and Aggregators to participate in any energy, capacity and ancillary services markets.
- (ii) In the mid-term: In the mid-term the following should be implemented:
 - (a) Adoption of regulations to establish the requirements for obtaining licensing or an authorisation to operate as BESS operator or Aggregator.
 - (b) Revision of technical regulations in order to determine if more specific requirements are necessary for allowing the participation and the interconnection of BESS operators.
 - (c) Adoption of industry standards applicable to batteries.
 - (d) Revision of legislation to ensure that there is no double imposition of fees, taxes and charges to BESS operators (when drawing electricity from the network and when injecting it)



- (e) Approval of environmental legislation applicable to BESS
- (f) Procurement: Only if the authorities intend to deploy BESS before the establishment of a national or regional competitive ancillary service market (to finance BESS operations), national authorities or grid operators may procure BESS installations (for instance by a competitive tender). In that case, the local procurement legislation is applicable and a Power Purchase Agreement will be signed after the procurement period defining the services to be provided and prices to be paid.

II. At regional level

- i. **Short-term:** In the short term the following actions should be implemented at regional level:
 - (a) Initiate the procedure for revision and approval of Draft Rules on BESS. Subsequently, approve these rules formally by a Resolution of ERERA.
 - (b) Initiate the procedure for revision and approval of Draft Environmental legislation related to BESS. Subsequently approve it formally.
 - (c) Amend, preferably through the Draft Rules on BESS, the following regional legislation:

(1) Article 9: of the Regional Electricity Market Procedures for the WAPP, approved by Resolution 010/ERERA/17 which establishes the minimum criteria for admission of a Market Participant. Its article 9 on “requirement at application” mentions example of information required to be provided as a condition of Market Participation and which Market Participants which Market Participants must be updated as necessary. But it only makes reference to network operators and generators. Article 9 should also establish the information to be required also to operators of BESS and aggregators. Thus, the following paragraphs should be added to section 9.01:

- “(c). For Operators of a Battery Energy Storage Systems and of Aggregators:*
- (i) the name plate capacity of the generator, expressed in MW,*
 - (ii) the minimum load at the connection point of the generator that will automatically trip off if the generator fails, expressed in MW;*
 - (iii) the sent out capacity of the generator, expressed in MW;*
 - (iv) the over-load capacity of the generator, if any, expressed in MW;*



- (v) *the minimum stable loading level of the generator, expressed in MW;*
- (vi) *the minimum dispatchable loading level of the generator, expressed in MW;*
- (vii) *any other information required for an undisturbed connection, in accordance with the requirements and access tariff to the WAPP interconnected transmission system.*

(d). The information to be provided pursuant to the previous paragraph by Operators of Battery Energy Storage Systems and Aggregators shall be informed in respect of both, the injection and the withdrawal capacity of the Battery Energy Storage System.”

- (2) The Regional Market Rules for the West African Power Pool approved by Resolution N° 005/ERERA/15, should be reviewed before the initiation of Phase 2 (article 12.b) since it should provide for a day-ahead market and other provisions there detailed. The foreseen revision of the Regional Market Rules shall also be modified to specify the criteria and conditions of participation of operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market.

Thus, the reviewed Regional Market Rules should provide products for trading in electricity markets in Phase 2 and 3 that are sufficiently small in size, to allow for the effective participation of BESS and of consumers through aggregators.

In addition, as the Regional Market Rules must be reviewed and prepared for the subsequent Phases following Market Phase 1 of the Regional Electricity Market, this article requires that such reviewed Regional Market Rules must “specify the criteria and conditions of participation of operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market”.

- (3) Section 0.3 “Presentation of WAPP” of the Operation Manual of the West African Power Pool approved by Resolution N° 007/ERERA/15 should be modified to add one paragraph that allows the participation of BESS operators and aggregators as WAPP members. It should allow membership in WAPP to “*to any entity, public or private, which-*



- (a) operates Battery Energy Storage Systems in accordance with the conditions of these Rules; or
- (b) performs aggregation.”

- (4) The Application Form (the ECOWAS Regional Electricity Market Participant Application Form approved by Resolution N° 013/ERERA/18 (Annex I) should be completed to establish the information that shall be requested to operators of Battery Energy Storage System and Aggregators to apply as Market Participants in the Regional Electricity Market. Until the ECOWAS Regional Electricity Market Participant Application Form is approved in accordance with this article, the regional System and Market Operator shall determine the information that Operators of Battery Energy Storage System and Aggregators who apply as Market Participants shall provide

2.9 Explanation of the draft Battery Energy Storage System Rules

2.9.1 Chapter I General Rules

Article 1

This article 1 contains a general explanation of the energy storage systems, and of BESS in particular.

The definitions contained in article 3 define energy storage, battery and BESS to avoid uncertainty and to differentiate energy storage from other activities as generation or consumption. In this regard, the international benchmarking included in the Due Diligence Report of WP 2 highlighted the importance of grating a differentiated statute to energy storage, and of establishing a minimum of rules related to the roles of energy storage in the electricity market.

Concerning BESS, this article explicitly indicates that it comprises any kind of BESS technology.

BESS may inject or withdraw electricity in an electricity market and may also provide different grid services. Therefore, BESS may play a role in any market, including the wholesale energy and balancing markets, as well as provide a wide range of services to the transmission and distribution grids, in order to ensure efficient, stable and reliable network operation. Thus, the draft BESS Rules explicitly indicate that “Battery Energy Storage Systems are eligible to provide any service that they are capable of providing in any of the Electricity Markets established or to be developed in the Regional Electricity Market in any of its phases of development”.



This article makes explicit reference to the different possible **alternatives** for the installations of BESS, before mentioned, which include the following:

1. The deployment of BESS as stand-alone facilities developed and operated by private or public operators/ persons (this alternative is named “centralised system” by the TORs of this consultancy).
2. The development of renewable energy projects co-located with utility-scale BESS, also known as hybrid projects (identified as “decentralised systems” by the TORs of this consultancy).
3. BESS is sited on customer premises and the storage system is connected to the distribution system on the customer’s side of the utility’s service meter (“behind the meter” alternative).
4. Isolated microgrids: installation of BESS in small power networks that can operate independently.
5. Customer-sited, off-grid battery storage systems: which makes reference to the installation of BESS on customer premises where the customer is not connected to the grid.

The draft BESS Rules mention that it is applicable to grid-scale Battery Energy Storage Systems, that is front-the-meter Battery Energy Storage Systems, including the centralised and decentralised alternatives, and behind-the-meter option.

To avoid gaps and uncertainties related to the services that the System and Market Operator may procure from BESS, the draft BESS Rules explicitly mention some of the services that BESS may provide. In this regard, it establishes that BESS as stand-alone facilities “may be used to provide different applications such as peaking capacity (BESS are used to meet demand during peak periods), Reserves (primary reserve or frequency containment reserve, spinning reserve, etc.), transmission and distribution replacement and deferral, and Black Start.” It also indicates that BESS deployment “with renewable energy projects improves the integration of intermittent renewable energy production projects”.

The reason why the main services that BESS may provide are explicitly mentioned in the draft BESS Rules is that even if BESS can provide grid services, it has been observed that if the legislation does not explicitly state that storage operators can provide grid services, system/market operators may be unwilling to procure those services from BESS. Moreover, storage developers and financing institutions may be unwilling to invest in storage unless they have a guarantee that they will be compensated for the services provided.



The draft BESS Rules also mention the main application that Behind-the-Meter BESS allow to customers, which includes arbitrage (shifting electricity consumption from high to low energy cost periods), provision of reliable access to power after a disruption to the grid (mainly if those disruptions or interruption in supply occur frequently), protection against short-duration events that affect the quality of the power delivered to the customers, among others.

As BESS may also be centrally coordinated, through aggregators, to offer different services to the grid, aggregation (the process of combining multiple small assets to act as a larger asset for the provision of specific services to the power system) is explicitly mentioned by the draft BESS Rules in article 1 and defined in article 3. In this regard, article 1 of the draft BESS Rules establish “As trades in electricity markets in general involve greater capacities than, for example, a household or an owner of electric cars could offer, there is a need to pool capacity from these flexible units. The aggregator's function is to pool electricity supply and/or demand and sell this capacity in the electricity markets Thus, aggregators are allowed to combine multiple customer loads or generated electricity for sale, purchase or auction in the Regional Electricity Market”.

Thus, the draft BESS Rules not only allow the participation in the Regional Electricity Market of operators of energy storage facilities individually but also of persons engaged in aggregation.

Concerning the project financing, the draft BESS Rules involves a “basic reform” as analysed in the Due Diligence Report of WP2. This implies that its objective is to establish a clear regulatory framework particularly applicable to BESS but allowing BESS participation, regardless of the technology, in the Regional Electricity Market.

Basic reforms have been established to allow energy storage developers to enter the energy market under competitive basis.

The reform should at least allow grid-scale and behind-the-meter installations providing demand-side response, to participate and earn revenue without discrimination and regardless of the technology under competitive basis. Those developers will be exposed to market risks and their establishment will depend on the business model that the market and legislation allow them.

Of course that ECOWAS member countries may decide to subsidise and procure BESS projects, either as stand-alone facilities or co-located with renewable energy generation, for instance, through a competitive tender. In this last case, the public procurement local legislation would be applicable and the local stakeholders (such as representatives of



governments or grid operators) should be involved in the procurement of the BESS. The tender may be launched either for the deployment of BESS as stand-alone facilities or for its collocation with a renewable energy generation project.

The Regional Electricity Market is in Phase 1. A Day-ahead Market will be established during Phase 2 of the Regional Electricity Market while a fully competitive Regional Electricity Market is expected to occur during Phase 3, that is in the long or very long term, when other markets, in particular a market for ancillary services, will be developed.

The draft BESS Rules mention in article 1 that the “postponement in the long term of the establishment of a fully competitive Regional Electricity Market may impede the financing of Battery Energy Storage Systems, ECOWAS member countries may also decide to subsidise and/or procure Battery Energy Storage projects, either as stand-alone facilities or co-located with renewable energy generation, for instance, through a competitive tender”. In this last case, the public procurement established in the local legislation would be applicable and rule the tender.

But the procurement by a tender or the adoption of any kind of subsidisation of all or specific BESS projects is not imposed by the regional legal framework.

This draft BESS Rules establish the requirements and rules that operators of Battery Energy Storage Systems must comply with to participate in the Regional Electricity Market.

The national legislation of ECOWAS member countries must establish the licensing or authorisation requirements that operators of Battery Energy Storage Systems and Aggregators must comply with to be allowed to perform energy storage.

Article 2:

This article:

- (a) establishes the name of this legislation: Battery Energy Storage System Rules; and
- (b) Indicates the applicability of the draft BESS Rules: to the System and Market Operator and to all market participants of the Regional Electricity Market, including operators of Battery Energy Storage Facilities and aggregators.

Article 3:

For consistency reasons, this article includes definitions already included in the ECOWAS legal documents more recently approved or drafted.

Therefore, many definitions were copied or adapted from the draft Regional Grid Code including: Ancillary Service, Black Start Capability, Day-ahead Market, ECOWAS Region, ERERA,



Electricity Markets, Grid Operator, Isolated Market Participant, Market Participant Agreement, National Grid Code, Primary Reserve or Frequency Containment Reserve, Reserves, Spinning Reserve, WAPP.

Other definitions were copied from the Regional Market Rules, such as Market Participant, Regional Electricity Market, System and Market Operator (the regional institution).

In addition, after analysing different definitions of Energy Storage and Battery, the best alternatives were considered the ones contained in the European Union legislation. Therefore, the definitions of Energy Storage and Battery were taken from the Directive (EU) N° 2019/944 and from the recently adopted Regulation (EU) 2023/1542 on batteries, respectively.

The rest of the definitions have been proposed by this consultancy, including the definition of BESS.

Article 4:

This article rules the “Participation in the Regional Market and Registration of Market Participants”.

The Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17 establishes the minimum criteria for admission of a Market Participant and the information required at application, but it only makes reference to network operators and generators. Therefore, this article extends the major rules of this regional legislation to also allow the participation of operators of BESS and of aggregators in the Regional Electricity Market.

This article establishes that operators of BESS must apply to the regional System and Market Operator (SMO) to be recognised as market participants and must sign a market participant agreement. Other additional rules of the mentioned legislation are also applicable.

Article 5:

Article 5, whose title is “Condition to apply as Market Participants” requires that operators of BESS and of Aggregators who intend to participate in the Regional Electricity Market shall be required to have previously obtained the licence or any other kind of authorisation that allows them to operate as Battery Energy Storage Systems or as Aggregators, respectively, in any of the countries where the West African Power Pool operates.

A similar rule (a licensing requirement) is currently applicable to the existing market participants by the regional legislation. In the draft BESS Rules the exigence is less restricted and thus it



requires to have obtained “a licence or any other kind of authorisation that allows them to operate” because in some countries, aggregators are not required to obtain a licence. In any case, the market entry requirement, such as a licence, should be decided by the legislation of the ECOWAS countries.

Article 6:

This article establishes the obligation of operators of BESS to comply with the technical, safety and environmental legislation established by –

- the regional legislation; and
- the legislation of the country where the operator of a BESS has been licensed or authorised to operate.

The preparation of an environmental legislation is part of this consultancy. Any additional environmental, safety or technical legislation in force in the country where the BESS is located is obviously applicable and mandatory for the operator of BESS.

Article 6 of the draft BESS Rules also states the obligation of operators of BESS to comply with national grid codes (since they are connected to the national electricity system) and with the regional grid code that will be approved at regional level. In this regard, the regional grid code, once approved, will be mandatory for all market participants.

Article 7:

Article 7 refers to “persons who may operate BESS in the Regional Electricity Market”.

The Market Code of the draft Regional Grid Code includes a rule that has an impact in this matter. In that regard, it establishes that entities engaged in the transmission operation and system operation cannot buy and sell electricity but have the duty and the rights to provide regional transmission services and system operation services. Those Entities engaged in providing both transmission and system operation services are called Grid Operators (M.C.1.3.3.5).

As market participants may be vertically integrated companies, to improve transparency and prevent anti-competitive practices, the Market Code of the draft regional Grid Code establishes that the vertically integrated company who intend to sell or withdraw energy in the regional market must establish a separate unit that will act as market participant (section MC1.10.10) and comply with certain conditions that ensure a functional separation of activities.



The application of this rule, that must have been discussed and agreed in the draft Regional Grid Code, is applicable to grid operators who intend to provide BESS firm capacity or grid services in the regional market seems obvious. Otherwise, there would be an inconsistency between both draft regional legislations.

In this regard, the rule should be applicable to the provision of BESS services in any electricity market that may exist currently or in the future (which includes energy, capacity and also ancillary services markets).

The draft Regional Grid Code mentions that market participants may be vertically integrated companies. Therefore, and to improve transparency and prevent anti-competitive practices, the Market Code of the draft Regional Grid Code establishes that vertically integrated company must establish a separate unit that will act as market participant (sections MC1.10.10) and complies with additional functioning requirements.

As mentioned in the benchmarking analysis of the Due Diligence Report of WP2, in the European Union, in the United Kingdom and in Germany, transmission and distribution system operators are not allowed to develop, own, maintain or operate energy storage facilities. The reason of such a prohibition is to avoid cross-subsidisation between energy storage and the regulated functions of distribution or transmission, and thus to prevent distortion of competition.

But the reason why this rule was included in this article is the provision contained in the draft Regional Grid Code.

Therefore, the limitations established in the Grid Code are included in the draft BESS Rules, whose text is the following:

“7 (2). To improve transparency and prevent anti-competitive practices, vertically integrated companies who are Grid Operators and also operate Battery Energy Storage Systems may provide energy, capacity or ancillary services in any of the Electricity Markets of the Regional Electricity Market provided that they establish a separate unit that will act as market participant to sell energy, capacity and ancillary services. Such separate unit shall-

- (a) Appoint one or more representatives that cannot be involved in grid operations activities, as long as they represent the unit operating in the Regional Electricity Market;*
- (b) Create a separate management and accounting system to manage and record all the activities related to the Regional transactions;*



- (c) *Define a formal and in-writing communication procedure with the unit responsible for grid operations within its own company, which must be approved by ERERA;*
- (d) *Keep ring-fenced information confidential;*
- (e) *Establish and maintain appropriate internal processes to ensure it complies with its obligations under the Market Code. ERERA must require the unit and the vertically integrated company to demonstrate the adequacy of these processes upon reasonable notice;*
- (f) *Prepare an annual Ring-Fencing Compliance Report each calendar year. The unit shall submit its annual compliance report to ERERA within four months of the end of the calendar year to which the compliance report relates.*

7 (3) *Notwithstanding the prohibition established in paragraph (1) of this article, Grid Operators who own and operate Battery Energy Storage Systems-*

- (a) *may operate Battery Energy Storage Systems to fulfil their obligations related to the efficient, reliable and secure operation of their transmission and distribution systems; and*
- (b) *may be allowed to provide any energy, capacity or ancillary service in their national electricity market if the national legislation allows them to do so.*

Paragraph (3) of article 7 of the draft BESS Rules clarifies that the limitations established in paragraph (2) are only applicable to the provision of electricity, capacity or ancillary services by Grid Operators in the Regional Electricity Market. Although it seems obvious, it explicitly states that the national legislation may allow them to provide those services in the national electricity market. This paragraph also indicates that they may operate those services to comply with their obligations.

We understand that as currently most utilities of ECOWAS member countries are vertically integrated, the establishment of a limitation for the direct provision of services by transmission / distribution system operators might constitute a barrier to the development of BESS. On the other hand, the draft BESS Rules are meant to last and remain applicable to the regional market in all its phases, including in the long or very long term (phase 3). The regional market is meant, in a third phase to develop a fully competitive regional market.

Nevertheless, this matter is specifically subject to consultation and discussion with stakeholders. It might be modified, but in that case the rules contained in sections



M.C.1.3.3.5 and MC1.10.10 of the draft Grid Code should also be amended. Otherwise, there would be a legal inconsistency.

Article 8:

This article explicitly allows “revenue stacking” to BESS operators.

As BESS may provide multiple system services, they should be allowed to earn revenue simultaneously from multiple sources using the same BESS. To avoid uncertainties that may create barriers to the development of electricity storage facilities, it is recommendable that the legislation should explicitly allow revenue stacking.

If the applicable legislation restricts the ability of BESS to provide services across different compensation sources, such limitation can influence how BESS are used and limit the financing options of BESS.

The situation is different if BESS are financed pursuant to a Power Purchase Agreement (PPA), in which case, the PPA should clarify the rights to different products and services as well as revenue streams that will be allowed. But the provisions contained in the BESS Rules establish the general rules applicable in a competitive regional electricity market since the establishment of PPAs for the deployment of BESS is not required by the BESS Rules.

The absence of rules regarding revenue stacking may create uncertainties, thus it is explicitly mentioned in the draft BESS Rules.

2.9.2. Chapter II- Amendments to Regional Legislation

Article 9:

The Regional Electricity Market Procedures for the WAPP, approved by Resolution 010/ERERA/17 establishes the minimum criteria for admission of a Market Participant.

Its article 9 on “requirement at application” mentions example of information required to be provided as a condition of Market Participation and which Market Participants which Market Participants must be updated as necessary. But it only makes reference to network operators and generators.

Article 9 of the draft BESS Rules adds to the Regional Electricity Market Procedures the example of information to be required also to operators of BESS and aggregators.

Article 10:



In accordance with the Regional Market Rules for the West African Power Pool approved by Resolution N° 005/ERERA/15, the Regional Market Rules should be reviewed before the initiation of Phase 2 (article 12.b) since it should provide for a day-ahead market and other provisions there detailed.

Thus article 10 of the draft BESS Rules establishes that the foreseen revision of the Regional Market Rules shall also specify the criteria and conditions of participation of operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market.

This article also explicitly establishes that the reviewed Regional Market Rules should provide products for trading in electricity markets in Phase 2 and 3 that are sufficiently small in size, to allow for the effective participation of BESS and of consumers through aggregators.

In addition, as the Regional Market Rules must be reviewed and prepared for the subsequent Phases following Market Phase 1 of the Regional Electricity Market, this article requires that such reviewed Regional Market Rules must “specify the criteria and conditions of participation of operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market”.

Article 11:

This article amends section 0.3 “Presentation of WAPP” of the Operation Manual of the West African Power Pool approved by Resolution N° 007/ERERA/15 to add one paragraph that allows the participation of BESS operators and aggregators as WAPP members.

Such paragraph allows membership in WAPP to “to any entity, public or private, which-

- (c) operates Battery Energy Storage Systems in accordance with the conditions of these Rules; or
- (d) performs aggregation.”

Article 12:

This article provides for the modification of the Application Form (the ECOWAS Regional Electricity Market Participant Application Form approved by Resolution N° 013/ERERA/18 (Annex I), in order to establish the information that shall be requested to operators of Battery Energy Storage System and Aggregators to apply as Market Participants in the Regional Electricity Market.





3 Draft Battery Energy Storage System Rules

3.1 Chapter I: General Rules

Article 1: Introduction

1 (1). Energy Storage is an activity of the electricity sector that must be differentiated from other activities, such as power generation. Therefore, these Rules contain a definition of this activity.

1 (2). There are different alternatives for storing energy in the electricity sector. Energy Storage has been historically dominated by Pumped Hydro Storage. In recent years Battery Energy Storage Systems have emerged as a key source of flexibility to integrate renewable power generation in the interconnected electricity network.

1 (3). Battery Energy Storage Systems may inject or withdraw electricity in an electricity market and may also provide different grid services. Therefore, Battery Energy Storage Systems may play a role in any market, including the wholesale energy and balancing markets, as well as provide a wide range of services to the transmission and distribution grids, in order to ensure efficient, stable and reliable network operation. Thus, Battery Energy Storage Systems should be eligible to provide any service that they are capable of providing in any of the Electricity Markets established or to be developed in the Regional Electricity Market in any of its phases of development.

1 (4). Battery Energy Storage Systems can have different applications, from short-term balancing of supply and demand, to restoring grid operation following a blackout, or deferring investment in new transmission and distribution lines

1 (5). The lack of an adequate legal framework constitutes an obstacle to the financing and deployment of Battery Energy Storage Systems. Therefore, these Rules establish the legal requirements for the participation of Battery Energy Storage Systems in the Regional Electricity Market.

1 (6). There are different technologies of Battery Energy Storage Systems, although recent projects are dominated by lithium-ion batteries. However, as the batteries energy storage technologies has experienced an important and continued evolution, these Rules are applicable to all currently available and future battery energy storage technologies.

1 (7). Battery Energy Storage Systems allow multidimensional applications and they should all be allowed and fostered. Thus, the legal framework should allow all possible alternatives for the



installations of Battery Energy Storage Systems in the ECOWAS region and in member countries, including the following:

- (a) The deployment of Battery Energy Storage Systems as stand-alone facilities developed and operated by private or public operators, called “Operators of Storage”.
- (b) The development of renewable energy generation projects co-located with utility-scale Battery Energy Storage Systems.
- (c) Battery Energy Storage Systems sited on customer premises and connected to the distribution system on the customer’s side of the utility’s service meter (Behind the Meter alternative), operated by an Aggregator.
- (d) Battery Energy Storage Systems installed in Isolated Microgrids, that is, in small power networks that can operate independently.

1 (8). These Rules are applicable to grid-scale Battery Energy Storage Systems, which includes Battery Energy Storage Systems established as stand-alone facilities, co-located with renewable energy generation projects, or sited on customer premises and connected to the distribution system.

1 (9). Battery Energy Storage Systems may be built on a standalone basis to charge from the power grid or as co-located system that charges directly from a generator that produces electricity from renewable energy to which it is connected.

1 (10). Grid-scale Battery Energy Storage Systems can be deployed in different locations: in the transmission network, in the distribution network near load centres, or co-located with variable renewable energy.

1 (11). The deployment of Battery Energy Storage Systems as stand-alone facilities may be used to provide different applications such as peaking capacity (used to meet demand during peak periods), Reserves (Primary Reserve or Frequency Containment Reserve, Spinning Reserve, etc.), transmission and distribution replacement and deferral, and Black Start.

1 (12). The deployment of Battery Energy Storage Systems with renewable energy generation projects improves the integration of intermittent renewable energy production.

1 (13). Behind-the-Meter Battery Energy Storage Systems allow customers to use Battery Energy Storage Systems for own application such as arbitrage (shifting electricity consumption from high to low energy cost periods), provide reliable access to power after a disruption to the grid (mainly if those disruptions or interruption in supply occur frequently), protect the customer against short-



duration events that affect the quality of the power delivered to the customers, etc. Behind-the-meter Battery Energy Storage Systems may also be centrally coordinated, through Aggregators, to offer different services to the grid. Aggregation is the process of combining multiple small assets to act as a larger asset for the provision of specific services to the power system.

1 (14). The participation in the Regional Electricity Market is not only allowed to energy storage facilities individually but also to market participants engaged in Aggregation.

1 (15). As trades in electricity markets in general involve greater capacities than, for example, a household or an owner of electric cars could offer, there is a need to pool capacity from these flexible units. The Aggregator's function is to pool electricity supply and/or demand and sell this capacity in the electricity markets. Thus, Aggregators are allowed to combine multiple customer loads or generated electricity for sale, purchase or auction in the Regional Electricity Market.

1 (16). The objective of These Rules is to establish the legal framework for allowing Battery Energy Storage Systems to participate in the Regional Electricity Market under competitive basis.

1 (17). A Day-Ahead Market will be established during Phase 2 of the Regional Electricity Market while a fully competitive Regional Electricity Market is expected to occur during Phase 3, that is in the long or very long term, when other Electricity Markets, in particular a market for ancillary services, will be developed.

1 (18). As the postponement in the long term of the establishment of a fully competitive Regional Electricity Market may impede the financing of Battery Energy Storage Systems, ECOWAS member countries may also decide to establish specific incentives or even procure Battery Energy Storage projects, either as stand-alone facilities or co-located with renewable energy generation, for instance, through a competitive tender. In this last case, the public procurement established in the local legislation would be applicable and rule the tender.

However, the subsidisation or the establishment of other kind of incentives for the deployment of all or specific Battery Energy Storage Systems projects is voluntary but not imposed by These Rules.

1 (19). These Rules establishes the requirements and rules for the operation of Battery Energy Storage Systems in the Regional Electricity Market.

1 (20) The national legislation of ECOWAS member countries must establish the licensing or authorisation requirements that operators of Battery Energy Storage Systems and Aggregators must comply with to be allowed to perform energy storage.



Article 2: Title and Application

2 (1). These Rules shall be called Battery Energy Storage System Rules.

2 (2). These Rules apply to the regional System and Market Operator and to all market participants, including operators of Battery Energy Storage Facilities and Aggregators.

2 (3). These Rules rule the participation of Battery Energy Storage Facilities and Aggregators as Market Participants in the Regional Electricity Market.

Article 3: Definitions and Abbreviations

In these Rules-

Aggregation means a function performed by a natural or legal person who combines multiple customer loads or generated electricity for sale, purchase or auction in any electricity market.

Aggregator means a natural or legal person who performs Aggregation.

Ancillary Service means a service other than the production of energy and/or provision of capacity, which is used to maintain reliability including reserves, frequency control, voltage control and Black Start Capability.

Arbitrage means, in the electricity system, charging or purchasing inexpensive electric energy, available during periods when prices of electricity are low, to charge the battery energy storage system so that the stored energy can be used or sold at a later time when the price are higher.

Battery means any device delivering electrical energy generated by direct conversion of chemical energy, having internal or external storage, and consisting of one or more non-rechargeable or rechargeable battery cells, modules or of packs of them, and includes a battery that has been subject to preparation for re-use, preparation for repurposing, repurposing or remanufacturing.

Battery Energy Storage System means, in the electricity system, a battery where energy storage occurs.

Day-ahead Market means the Regional Market to trade energy in the short term with an established clearing price mechanism through matching bids and offers for the next operating day.



Distribution System means all high, medium and low voltage lines and related equipment owned, maintained and operated by an Entity, which are directly connected to the Transmission System through substations and used for the transport of electricity with a view to its delivery to end-consumers.

ECOWAS means the Economic Community of West African States established by the ECOWAS Treaty signed on the 28th of May 1975 in Lagos, Nigeria.

Electricity Markets means the markets in which Market Participants are allowed to trade, such as the Day-ahead Market.

Energy Storage means, in the electricity system, deferring the final use of electricity to a moment later than when it was generated, or the conversion of electrical energy into a form of energy which can be stored, the storing of such energy, and the subsequent reconversion of such energy into electrical energy or use as another energy carrier;

Energy Storage System means, in the electricity system, a facility where energy storage occurs

ERERA or ECOWAS Regional Electricity Regulatory Authority means the regulator of regional cross-border trade of electricity in the West Africa Power Pool. It is mandated to regulate the regional electricity market, as defined by Regulation C/REG.27/12/07 on the Composition, Organisation, Functions, and Operations of ECOWAS Regional Electricity Regulatory Authority.

Grid Operator means to the Entity designated by each Member State to perform functions of management of the Transmission System, and balancing for the relevant Power Systems and the Cross-border Interconnection at every voltage level. Given the different national unbundling configurations of the electricity sector in the Region, the term may refer to one or more independent national undertakings or department/sector of the same vertically integrated utility operating in each Member State, whose relevant functions and relations shall be regulated by specific agreements in each national Member State. The term “Grid Operator” considers only the utilities that are also WAPP Members, and which are subject to the duties and responsibilities towards WAPP.

Isolated Microgrid means a microgrid not intended to connect to a wider electric Power System, working as a stand-alone system.

Intra-day market means a market where market participants trade continuously, 24 hours a day with delivery on the same day.



Market Participant means a company of electricity supply industries of any of the WAPP countries that has followed the procedure and has been registered by the System and Market Operator as Market Participant.

Market Participant Agreement means the Agreement under which the System and Market Operator and each Market Participant shall agree and observe and perform the requirements of the Regional Market Rules.

National Grid Code means the technical rules for the national management of each single Power System of the Member States.

Operator of Energy Storage System means an entity who operates an Energy Storage System.

Primary Reserve or Frequency Containment Reserve means the Reserve available to contain the frequency deviation after an unbalance in the Power System.

Regional Electricity Market: All cross-border electricity trading and related services made through the regional interconnected transmission networks within the ECOWAS sub-region.

Regional Legislation means any legislation in force in the ECOWAS region.

Reserves means all active power resources, if procured ex ante or in real-time, or according to legal obligations, which are available to the Grid Operators for balancing purposes and maintaining the frequency.

Spinning Reserve means the unused capacity available from Generation Units or equivalent power resources working already synchronously with the Transmission System which can compensate power Shortages or frequency drops within a given period of time.

System and Market Operator or SMO: Regional institution responsible for regional market operation functions and additionally some system operation functions in the field of coordinating flows and allocating transmission capacity.

These Rules means the Battery Energy Storage System Rules.

West African Power Pool or WAPP means a specialised institution of ECOWAS established by Decision A/DEC.20/01/06 of January 12, 2006, by the Conference of Heads of State and Governments, with a responsibility to develop electricity infrastructure and establish a Regional Electricity Market.



Article 4 : Participation in the Regional Market and Registration of Market Participants

4 (1). A person who operates a Battery Energy Storage System located in an ECOWAS will be allowed to participate in the Regional Electricity Market provided that such person-

- (a) applies to the System and Market Operator to be admitted as a Market Participant; and
- (b) is admitted as Market Participant by the System and Market Operator.

4 (2). The Operators of Battery Energy Storage Systems and Aggregators admitted as Market Participants will be included in the Register that the System and Market Operator must maintain pursuant to article 8 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17.

4 (3). Section 8.05 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17 is also applicable to the application fees and participation requirements of Operators of Battery Energy Storage Systems and of Aggregators in the Regional Electricity Market.

4 (4). Section 8.06 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17, which establishes the minimum criteria required for the admission of Market Participants, is applicable to the admission of Operators of a Battery Energy Storage Systems and of Aggregators as Market Participants in the Regional Electricity Market.

4 (5). Operators of Battery Energy Storage Systems and Aggregators who intend to participate in the Regional Electricity Market shall sign a Market Participant Agreement with the System and Market Operator.

4 (6). Operators of Battery Energy Storage Systems and Aggregators who participate in the Regional Electricity Market shall comply with all applicable Regional Legislation.



Article 5: Condition to apply as Market Participants

Operators of Battery Energy Storage Systems and of Aggregators who intend to participate in the Regional Electricity Market shall be required to have previously obtained the licence or any other kind of authorisation that allows them to operate as Battery Energy Storage Systems or as Aggregators, respectively, in any of the countries where the West African Power Pool operates.

Article 6: Compliance with regional technical, safety and environmental legislation

Operators of Battery Energy Storage Systems who intend to participate in the Regional Electricity Market shall comply with the technical, safety and environmental requirements established by-

- (a) the Regional Legislation; and
- (b) the legislation of the country where the Operator of a Battery Energy Storage System has been licensed or authorised to operate.

Article 7: Persons who may operate Battery Energy Storage Systems in the Regional Electricity Market

7 (1). Grid Operators, that is persons engaged in transmission operation and system operation, shall only be allowed to provide energy, capacity or ancillary services in any of the Electricity Markets of the Regional Electricity Market established or to be established provided that they comply with the requirements established in paragraph (2) of this article.

7 (2). To improve transparency and prevent anti-competitive practices, vertically integrated companies who are Grid Operators and also operate Battery Energy Storage Systems may provide energy, capacity or ancillary services in any of the Electricity Markets of the Regional Electricity Market provided that they establish a separate unit that will act as market participant to sell energy, capacity and ancillary services. Such separate unit shall-

- (a) Appoint one or more representatives that cannot be involved in grid operations activities, as long as they represent the unit operating in the Regional Electricity Market;
- (b) Create a separate management and accounting system to manage and record all the activities related to the regional transactions;



- (c) Define a formal and in-writing communication procedure with the unit responsible for grid operations within its own company, which must be approved by ERERA;
- (d) Keep ring-fenced information confidential;
- (e) Establish and maintain appropriate internal processes to ensure it complies with its obligations under the Market Code. ERERA must require the unit and the vertically integrated company to demonstrate the adequacy of these processes upon reasonable notice;
- (f) Prepare an annual Ring-Fencing Compliance Report each calendar year. The unit shall submit its annual compliance report to ERERA within four months of the end of the calendar year to which the compliance report relates.

7 (3) Notwithstanding the prohibition established in paragraph (1) of this article, Grid Operators who own and operate Battery Energy Storage Systems-

- (a) may operate Battery Energy Storage Systems to fulfil their obligations related to the efficient, reliable and secure operation of their transmission and distribution systems; and
- (b) may be allowed to provide any energy, capacity or ancillary service in their national electricity market if the national legislation allows them to do so.

Article 8: Revenue stacking

Operators of Battery Energy Storage Systems who provides multiple system services in the Regional Electricity Market shall be allowed to earn revenues simultaneously from multiple sources using the same Battery Energy Storage System.

3.2 Chapter II: Amendment or completion of Regional Legislation

Article 9: Regional Electricity Market Procedures for the West African Power Pool

Article 9 “Information required at application” section 9.01 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17 is hereby amended by the addition of the following paragraph:

- (c). For Operators of a Battery Energy Storage Systems and of Aggregators:
 - (5) the name plate capacity of the generator, expressed in MW,
 - (6) the minimum load at the connection point of the generator that will automatically trip off if the generator fails, expressed in MW;
 - (7) the sent out capacity of the generator, expressed in MW;



- (8) the over-load capacity of the generator, if any, expressed in MW;
- (9) the minimum stable loading level of the generator, expressed in MW;
- (10) the minimum dispatchable loading level of the generator, expressed in MW;
- (11) any other information required for an undisturbed connection, in accordance with the requirements and access tariff to the WAPP interconnected transmission system.

(d). The information to be provided pursuant to the previous paragraph by Operators of Battery Energy Storage Systems and Aggregators shall be informed in respect of both, the injection and the withdrawal capacity of the Battery Energy Storage System.

Article 10: Regional Market Rules

10 (1). The Regional Market Rules for the West African Power Pool approved by Resolution N° 005/ERERA/15 which shall be reviewed in accordance with such Resolution shall also specify the criteria and conditions of participation of Operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market.

10 (2). The reviewed Regional Market Rules shall provide products for trading in electricity markets in Phase 2 and 3 that are sufficiently small in size, to allow for the effective participation of BESS and of consumers through aggregators.

10 (3). The Regional Market Rules, which pursuant to article 8 of the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17 must be reviewed before the initiation of Market Phase 2, shall specify the criteria and conditions of participation of Operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets that will exist in the Regional Electricity Market.

Article 11: Operation Manual of the West African Power Pool

Section 0.3. "Presentation of WAPP" of the Operation Manual of the West African Power Pool approved by Resolution N° 007/ERERA/15 is hereby amended by the addition of the following paragraph:

- "Membership in WAPP Organisation is also open to any entity, public or private, which-
- (a) operates Battery Energy Storage Systems in accordance with the conditions of These Rules; or
 - (b) performs aggregation."



Article 12: Regional Electricity Market Participant Application Form

12 (1). The ECOWAS Regional Electricity Market Participant Application Form approved by Resolution N° 013/ERERA/18 (Annex I), shall be completed to establish the information that shall be requested to Operators of Battery Energy Storage System and Aggregators to apply as Market Participants in the Regional Electricity Market.

12 (2). Until the ECOWAS Regional Electricity Market Participant Application Form is approved in accordance with this article, the regional System and Market Operator shall determine the information that Operators of Battery Energy Storage System and Aggregators who apply as Market Participants shall provide.



4 Conclusions and recommendations

4.1 Conclusions

The proposed Rules on BESS constitutes a draft legal framework that avoids uncertainties (for instance including a definition of energy storage) and that ensures that all energy markets are open to the participation of BESS for the provision of any kind of service that energy storage systems are capable of providing.

It allows all possible alternatives for the installations of BESS in the ECOWAS region and in member countries, including the following:

- (a) The deployment of BESS as stand-alone facilities developed and operated by private or public operators/ persons (this alternative is named “centralised system” by the TORs of this consultancy).
- (b) The development of renewable energy projects co-located with utility-scale BESS (also known as hybrid projects (identified as “decentralised systems” by the TORs of this consultancy)
- (c) BESS is sited on customer premises and the storage system is connected to the distribution system on the customer’s side of the utility’s service meter (“behind the meter” alternative).
- (d) Microgrids: installation of BESS in small power networks that can operate independently.
- (e) Customer-sited, off-grid battery storage systems, which are not connected to the grid.

The draft BESS Rules are focused on grid-scale BESS in this grid, including front-the-meter and behind-the-meter storage, while the last two options before mentioned (microgrids and customer-sited off grid) are excluded from the application of the draft Rules

The draft Rules also includes the definitions of energy storage, battery and BESS to avoid uncertainty and to differentiate energy storage from other activities as generation or consumption.

They also explicitly indicate who may own and operate energy storage systems in general, including BESS.



BESS may inject or withdraw electricity in an electricity market and may also provide different grid services. Therefore, the draft Rules indicate that BESS may play a role in any market, including the wholesale energy and balancing markets, as well as provide a wide range of services to the transmission and distribution grids, in order to ensure efficient, stable and reliable network operation.

To avoid gaps and uncertainties related to the services that the System and Market Operator may procure from BESS, the draft BESS Rules explicitly mention some of the services that BESS may provide, such as peaking capacity (BESS are used to meet demand during peak periods), Reserves (primary reserve or frequency containment reserve, spinning reserve, etc.), transmission and distribution replacement and deferral, and Black Start. The reason for the inclusion of this paragraph is to avoid a possible barrier because if the legislation does not explicitly state that storage operators can provide grid services, system/market operators may be unwilling to procure those services from BESS.

As BESS may also be centrally coordinated, through aggregators, to offer different services to the grid, aggregation (the process of combining multiple small assets to act as a larger asset for the provision of specific services to the power system) is explicitly mentioned by the draft BESS Rules in article 1 and it is defined in article 3. Therefore, the Rules on BESS not only explicitly allows the participation in the Regional Electricity Market of operators of energy storage facilities individually but also of persons engaged in aggregation.

Concerning the project financing, the draft BESS Rules involves a “basic reform” as analysed in the Due Diligence Report of WP2. This implies that its objective is to establish a clear regulatory framework particularly applicable to BESS but allowing BESS participation, regardless of the technology, in the Regional Electricity Market.

Basic reforms have been established to allow energy storage developers to enter the energy market under competitive basis.

The reform should at least allow grid-scale and behind-the-meter installations providing demand-side response, to participate and earn revenue without discrimination and regardless of the technology under competitive basis, which means that those developers will be exposed to market risks and their establishment will depend on the business model that the market and legislation allow them.



However, the Regional Electricity Market is in Phase 1. A Day-ahead Market will be established during Phase 2 of the Regional Electricity Market while a fully competitive Regional Electricity Market is expected to occur during Phase 3, that is in the long or very long term, when other markets, in particular a market for ancillary services, will be developed.

Therefore, the deployment of BESS under competitive basis is foreseen in the long or very long term.

Additional incentives, such as the performance payment that Order 755 of the FERC imposed in the United States (to compensate resources that can provide faster-ramping frequency regulation), are not imposed by the BESS Rules, they are not recommended at least at this stage of the Regional Electricity Market.

Nevertheless, if ECOWAS member countries want to deploy BESS before the establishment of a competitive electricity market, they may decide to procure such installations by other means. In this last case, the public procurement local legislation would be applicable and the local stakeholders (such as representatives of governments or grid operators) should be involved in the procurement of the BESS.

The legislation of the country or countries that decide to procure BESS before the establishment of a competitive electricity market will define the alternatives and the authorities that have competence for conducting such procurement (for instance, ministries responsible for energy).

Two main alternatives are a competitive tender (which is the most transparent manner) or negotiation, but in any case, the procuring alternatives that the authorities have are defined in the legislation of each country.

The procurement of BESS by the authorities of any ECOWAS country may be launched either for the deployment of BESS as stand-alone facilities or for its collocation with a renewable energy generation project.

The mentioned alternatives are explicitly mentioned in the draft Rules on BESS, but the procurement by a tender or the adoption of any kind of subsidisation of all or specific BESS projects is not imposed by the regional legal framework.



The Rules on BESS also amend the Regional Electricity Market Procedures for the West African Power Pool approved by Resolution N° 010/ERERA/17 which establishes the minimum criteria for admission of a Market Participant and the information required at application, because it only makes reference to network operators and generators. With the amendment, the amended Procedures will explicitly establish the minimum criteria and information that will be required for the participation of operators of BESS and of aggregators in the Regional Electricity Market.

The Rules on BESS also establish the requirement of requires that operators of BESS and of Aggregators who intend to participate in the Regional Electricity Market shall be required to have previously obtained the licence or any other kind of authorisation that allows them to operate in any of the countries where the West African Power Pool operates. The type of authorisation or licence that is required must be determined by the national legislation of ECOWAS countries.

In accordance with the draft Rules, operators of BESS to also comply with the technical, safety and environmental legislation established by the regional legislation and by the legislation of the country where the operator has been authorised or licensed.

The draft Rules on BESS also makes a specific reference to persons who may operate BESS in the regional market. In this regard, it **extends a rule established in the draft Regional Grid Code that indicates that Grid Operators, that is entities engaged in the transmission operation and system operation, cannot buy and sell electricity but have the duty and the rights to provide regional transmission services and system operation services.**

The application of this rule, that must have been discussed and agreed in the draft Regional Grid Code, is applicable to grid operators who intend to provide BESS firm capacity or grid services in the regional market seems obvious. Otherwise, there would be an inconsistency between both draft regional legislations.

In this regard, the rule should be applicable to the provision of BESS services in any electricity market that may exist currently or in the future (which includes energy, capacity and also ancillary services markets).

The draft Regional Grid Code mentions that market participants may be vertically integrated companies. Therefore, and to improve transparency and prevent anti-competitive practices, the Market Code of the draft Regional Grid Code establishes that vertically integrated company must establish a separate unit that will act as market participant (sections MC1.10.10) and complies with additional functioning requirements.



The reason why this rule was included in this article is the provision contained in the draft Regional Grid Code.

Therefore, the limitations established in the Grid Code are included in the draft BESS Rules, which indicates that to improve transparency and prevent anti-competitive practices, vertically integrated companies who are Grid Operators and also operate Battery Energy Storage Systems may provide energy, capacity or ancillary services in any of the Electricity Markets of the Regional Electricity Market provided that they establish a separate unit that will act as market participant to sell energy, capacity and ancillary services. The Rules establishes also the requirements of the functioning of that separate unit.

We understand that as currently most utilities of ECOWAS member countries are vertically integrated, the establishment of a limitation for the direct provision of services by transmission / distribution system operators might constitute a barrier to the development of BESS. On the other hand, the draft BESS Rules are meant to last and remain applicable to the regional market in all its phases, including in the long or very long term (phase 3). The regional market is meant, in a third phase to develop a fully competitive regional market.

Nevertheless, this matter is specifically subject to consultation and discussion with stakeholders. It might be modified, but in that case the rules contained in sections M.C.1.3.3.5 and MC1.10.10 of the draft Grid Code should also be amended. Otherwise, there would be a legal inconsistency.

The draft Rules on BESS also explicitly allow revenue stacking because as BESS may provide multiple system services, they should be allowed to earn revenue simultaneously from multiple sources using the same BESS.

The draft Rules also modifies the Regional Electricity Market Procedures for the WAPP, approved by Resolution 010/ERERA/17, which establishes the minimum criteria for admission of a Market Participant. Under such amendment, the kind of information to be required also to operators of BESS and aggregators are also included.

The Regional Market Rules for the West African Power Pool approved by Resolution N° 005/ERERA/15 establish that the Regional Market Rules should be reviewed before the initiation of Phase 2 (article 12.b). These Rules makes an amendment to require that the modifications of



that Resolution should also specify the criteria and conditions of participation of operators of Battery Energy Storage Systems and of Aggregators in the different Electricity Markets.

The Operation Manual of the West African Power Pool approved by Resolution N° 007/ERERA/15 is also amended to add one paragraph that allows the participation of BESS operators and aggregators as WAPP members.

Finally, the draft Rules provide for the modification of the Application Form (approved by Resolution N° 013/ERERA/18 (Annex I), in order to establish the information that shall be requested to operators of Battery Energy Storage System and Aggregators to apply as Market Participants in the Regional Electricity Market.

4.2 Recommendations

At national level, the development of energy storage systems, including BESS, will be strengthened as the proportion of renewable energy in the electricity sector matrix increases.

The lack of an adequate legal framework constitutes an obstacle to the financing and deployment of energy storage systems. In this sense, it is necessary that the basic reforms mentioned in the table be implemented. Therefore, this reform requires at least:

- 1) That electricity storage is defined in the national legislation and, preferably, that it be specifically defined and differentiated from the electricity generator or consumer. If, on the other hand, the legislation assimilates him to an electricity consumer, it is important to avoid the double imposition of tariffs and taxes (when drawing electricity from the network and when injecting it) because this constitutes an obstacle to the development of energy storage systems.
- 2) That the legal framework indicates which persons (producers, network managers, others) are allowed to own and operate energy storage systems;
- 3) That the legislation authorises the participation of aggregators in competitive electricity markets (energy, capacity and ancillary services).

Markets are also necessary to finance energy storage system projects. In this sense, if there are competitive markets for energy, capacity and ancillary services, it should be indicated in the legislation that energy storage system operators can participate in them.

If there are no competitive markets for energy and ancillary services in which BESS can participate, then another mechanism for financing energy storage systems is necessary. This includes incentive measures to encourage electricity storage (e.g. measures such as facilitating



long-term contracts or recognition of specific performance payments) and/or direct subsidy and support mechanisms.