

Article

Harmonizing the Electricity Markets in Africa: An Overview of the Continental Policy and Institutional Framework towards the African Single Electricity Market

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Abstract: Africa is a huge continent with an area equal to 30,244,049 km² and a population of over 1.3 bn. According to the World Energy Outlook 2021, the electrification rate for Sub-Saharan Africa is at 79% for urban areas and only 28% for the rural areas. Given the low electricity infrastructure in Africa in production, transmission and distribution as well as the very low access in rural areas, it is understood that coordinated activities must take place for both on-grid and off-grid electrification activities, if the targets set for 2030 are to be met. This paper aims to present the challenges faced in the harmonization of the electricity markets in Africa due to the complexities of political continental integration, as well as continental economic integration, by performing a review of the progress made so far. It is one of the few efforts that have aimed to present in a single document the institutional framework of the electricity sector in Africa, and how these institutions collaborate in order to form and deploy policies at the continental and regional levels, affecting ultimately the deployment of policies at the national level. It also presents the current status of the continental electricity market policy framework activities towards the achievement of the 2030 goals in line with Agenda 2063, and the crucial role the African Single Electricity Market (AfSEM) is set to play. Finally, it provides lessons learnt and recommendations on facilitating the way forward in terms of the institutional actors' collaboration, both for Africa and globally, in terms of developing regional energy markets.

Keywords: electricity markets harmonization; African union; single electricity market; continental power systems master plan



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1. Introduction

Africa is a huge continent with an area equal to 30,244,049 km² and a population of over 1.3 bn. The Northern Africa countries have an electrification rate of over 99%, which is not the case in Sub-Saharan Africa. According to the World Energy Outlook 2021, the electrification rate for Sub-Saharan Africa is at 79% for urban areas and only 28% the rural areas [1]. Access to affordable and clean energy is one of the Sustainable Development Goals (SDG) of the United Nations (UN) [2]. The target for 2030 seems hard to reach, but many African countries deploy numerous activities towards it. Given the low electricity infrastructure in Africa in production, transmission and distribution as well as the very low access in rural areas, it is understood that coordinated activities must take place for both on-grid and off-grid electrification activities, if the targets by 2030 are to be met. It is important to note that access to electricity plays a very crucial role in a big number of SDGs from poverty eradication (SDG 1) to climate action (SDG 13), with effects on health (SDG 3), education (SDG 4), water supply (SDG 6) and industrialization (SDG 9), as is depicted in Figure 1 [3]. It is clear that achieving electrification is a prerequisite or facilitator in achieving most of the Sustainable Development Goals, especially for developing nations.

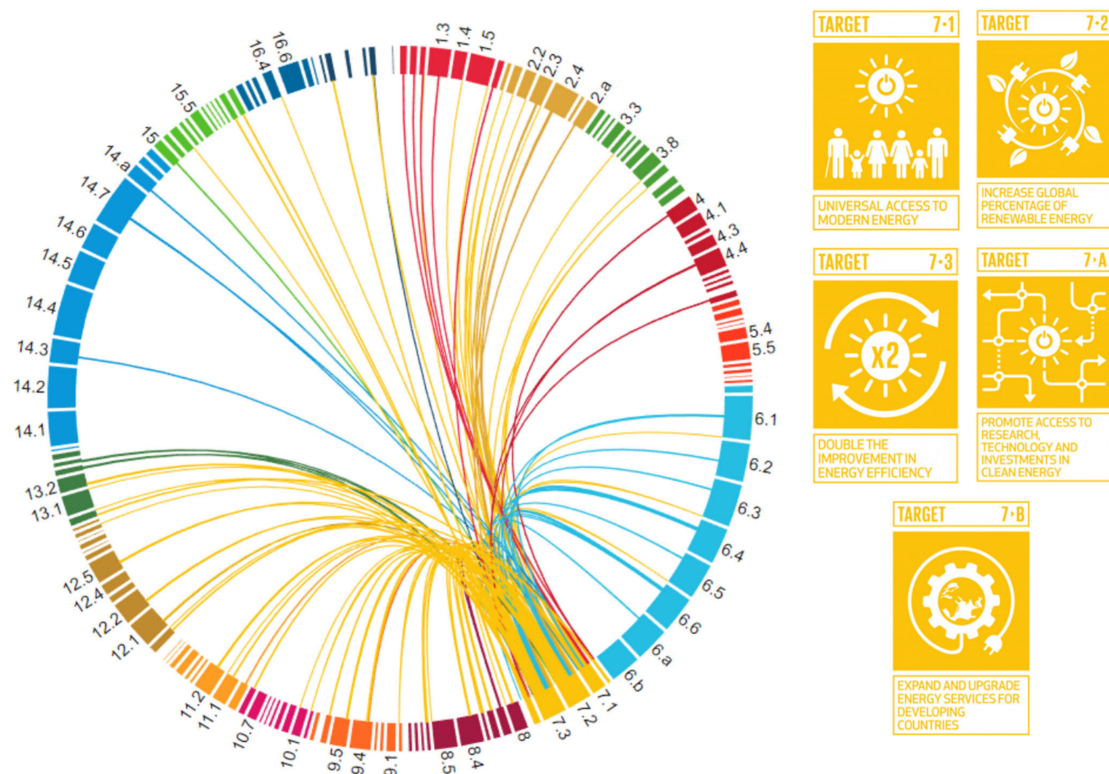


Figure 1. SDG 7 interlinkages based on the JRC tool (source: <https://knowsdgs.jrc.ec.europa.eu/interlinkages-visualization>, accessed on 20 July 2022).

Regional electricity markets are essentially the interconnection of already existing national electricity markets. The main pursuits of a regional electricity market can be identified as enhancing the security of supply and reduce costs. Their impact is increased as the national electricity markets become liberalized. While regional markets have existed for decades, they have become more important in recent times due to the benefits they provide in the integration of variable renewable energy sources by developing locational and temporal synergies [4]. The different levels of regional market integration are presented in Table 1. The European Union (EU) and the USA have realized the most advanced regional markets, while different regions of Africa have pursued regional electricity market development. Figure 2 presents examples of regional electricity market integration levels from around the world depending on the regional market design. The importance of regional markets is expected to continue rising globally in order to achieve higher variable renewable energy sources integration, as well as for decreasing electricity costs.

Table 1. Regional market integration levels.

	Early Stage	Shallow Market Integration	Deep Market Integration
Interconnectivity level	Two countries have the power grids interconnected	More than two neighboring countries are interconnected	Multi-country fully synchronous grid is accomplished
Trading arrangements	Long-term bilateral power purchase agreements	Long-term power purchase agreements supplemented with short-term wholesale markets	Fully competitive well-functioning markets
Harmonization rules	Simple rules agreed	Market rules, grid codes and transmission tariffs are harmonized	Full market harmonization with regional regulatory authorities and regional market operators

Adapted from: [4].

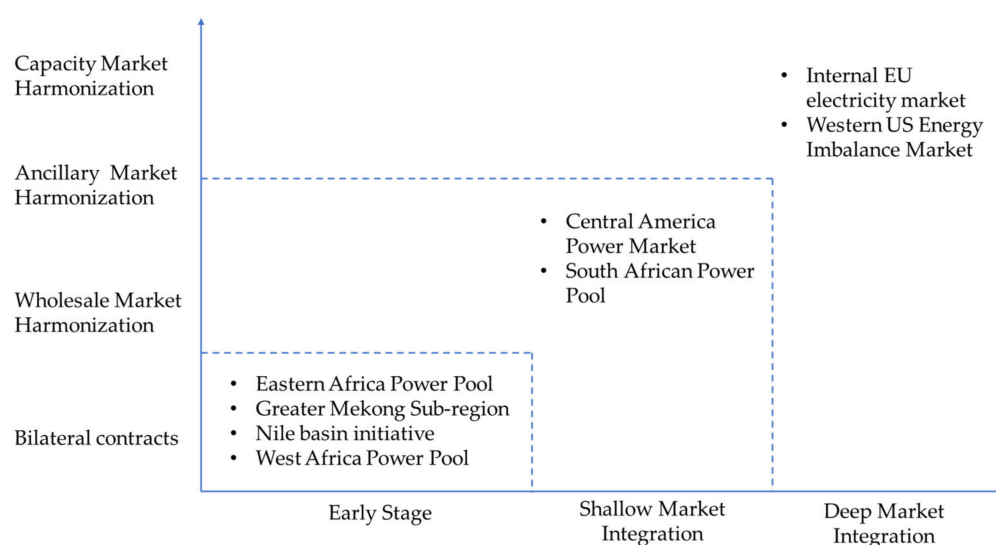


Figure 2. Regional electricity market integration levels from around the world (adapted from: [4]).

This paper aims to present the challenges faced in the harmonization of the electricity markets in Africa due to the complexities of political continental integration as well as continental economic integration. The institutional framework of the African electricity sector is presented in detail, as is a review of the current policy situation in Africa in terms of the electricity market, the activities undertaken and planned towards the achievement of the 2030 goals and the crucial role the African Single Electricity Market (AfSEM) is set to play. Finally, recommendations are provided based on the experience gained in the past years for facilitating the way forward in terms of the institutional actors' collaboration. This research paper is one of the first efforts to document the steps made and progress achieved so far in realizing the largest electricity market globally. While other works have focused on the more technical aspects of regional electricity market integration, e.g., [5], or market harmonization aspects such as tariff issues, e.g., [6], this paper aims to highlight how the 55 sovereign member states of the African Union (AU) have collaborated in order to realize the African Single Electricity Market.

2. Integration in the African Continent

2.1. Political Integration

2.1.1. African Union

The AU is a continental union currently consisting of 55 countries [7]. It was announced in 1999 in the Sirte Declaration in Libya, founded in Ethiopia in 2001 and launched in South Africa in 2002, replacing the Organization of African Unity (OAU). The African Union has a number of political and administrative bodies, with the highest decision-making organ being the Assembly of the African Union (AU Summit). The Pan-African Parliament is the representative body of the AU.

One of the biggest debates relevant on the means to achieve continental integration is whether to give priority to the integration of the continent as a unit in itself, or priority to regional integration first. The Abuja Treaty in 1991 [8] established the Regional Economic Communities (RECs) as the base for African integration.

2.1.2. Regional Economic Communities

All the RECs were established by a treaty among the member states. The main objective of the RECs is the facilitation of regional economic integration and ultimately continental integration under the AU. It must be noted that there are other regional bodies and unions, such as the Indian Ocean Commission (IOC), which have not been recognized as an REC by the AU. Each REC based on their founding treaty, among others, has legislative powers to pass statutes which bind the member states. Currently, the following eight regional

organizations have been recognized by the AU as RECs, along with a short summary of their main objectives. It has to be noted that only ECOWAS is currently able to issue directives.

- **The Common Market for Eastern and Southern Africa (COMESA)**

The COMESA Treaty was signed in 1993 and came into force in 1994. The COMESA Treaty is a successor of the Preferential Trade Area (PTA) Treaty which came into force in 1982. Its aims and objectives include *“Attaining sustainable growth and development of member states by promoting harmonious development; promotion of joint development in all fields of economic activity; cooperate to create an enabling environment for foreign, cross border and domestic investment; cooperate in the promotion of peace, security and stability among member states; cooperate in strengthening relations; cooperate in the establishment, progress and the realization of the African Economic Community”* [9].

- **The Community of Sahel-Saharan States (CEN-SAD)**

CEN-SAD was established in 1998. Its objectives include *“implementing community and local development plans for sustained socio-economic development in agriculture, industry, energy social and cultural fields as well as in health; the removal of restrictions hampering the integration of region; free movement of persons, capital and services; the right of establishment, ownership and exercise of economic rights”* [10].

- **The East African Community (EAC)**

The EAC Treaty was signed in 1999 and entered into force in 2000. Its objectives are—*“to develop policies and programmes aimed at widening and deepening cooperation among partner states in political, economic, social and cultural fields, research, technical, defence, security, legal and judicial affairs, and for their mutual benefit”* [11].

- **The Economic Community of Central African States (ECCAS)**

The ECCAS Treaty was enacted in 1982 and entered into force in 1983. Its objectives include *“liberalization of trade; freedom of movement, residence and establishment; cooperation in various fields such as monetary and financial transactions, industry, energy and natural resources”* [12].

- **The Economic Community of West African States (ECOWAS)**

The ECOWAS Treaty was signed in 1975 as revised. The aims and objectives of the Treaty include *“Harmonization and coordination of national policies and the promotion of integration programmes; and achieving the above through measures including, liberalization of trade by abolition among member states of duties, non-tariff barriers towards establishing a free trade area; facilitation of free movement of goods, services and capital; adoption of measures for integration of private sector; and creating an enabling environment for investment”* [13].

- **The Intergovernmental Authority on Development (IGAD)**

The agreement establishing IGAD entered into force in December, 1996. The aims and objectives of the authority include *“promotion of joint development strategies and harmonization of macro- economic policies in social, technological and scientific fields; harmonization of policies regarding trade and promotion of free movement of goods, services and people; creating an enabling environment for foreign, cross border and domestic trade and investment; developing coordinated infrastructure, particularly in the areas of transport and energy; and promoting and realizing the objectives of IGAD”* [14].

- **The Southern Africa Development Community (SADC)**

The Treaty establishing SADC was signed in 1992 and entered into force in 1993. Its objectives include *“active development and economic growth, alleviation of poverty, enhancing the standard of life through regional integration; evolving common political values, systems and institutions; achieving sustainable utilization of natural resources and the effective protection of the environment”* [15].

- **The Arab Maghreb Union (UMA)**

The UMA Treaty was signed in 1989. The aims for creating the union include “*enhancing brotherhood and uniting its peoples; achieving progress; prosperity among the member states; preservation of peace based on justice and equality; developing common policies in various fields and progressively implement free circulation of persons, goods and capital*” [16].

2.1.3. Multi-Membership in RECs

Membership in these RECs overlaps. The rationalization of membership has been under discussion for a while, and since 2007, the General Assembly of the AU has adopted a protocol for the relations between the AU and RECs intended to facilitate the harmonization of policies. Table 2 presents the memberships of each country to the various RECs. It can be observed that 12 countries have 1 membership, 34 countries have 2 memberships, 7 countries have 3 memberships and Kenya has 4 memberships.

Table 2. REC countries’ memberships.

Country Name	CEN-SAD	COMESA	EAC	ECCAS	ECOWAS	IGAD	SADC	UMA	Total
Algeria								✓	1
Angola				✓			✓		2
Benin	✓				✓				2
Botswana							✓		1
Burkina Faso	✓				✓				2
Burundi		✓	✓	✓					3
Cameroon				✓					1
Cape Verde					✓				1
Central African Republic	✓			✓					2
Chad	✓			✓					2
Comoros	✓	✓							2
Democratic Republic of the Congo		✓		✓			✓		3
Congo				✓					1
Djibouti	✓	✓				✓			3
Egypt	✓	✓							2
Equatorial Guinea	✓			✓					2
Eritrea	✓	✓				✓			3
Eswatini		✓					✓		2
Ethiopia		✓				✓			2
Gabon				✓					1
Gambia	✓				✓				2
Ghana	✓				✓				2
Guinea	✓				✓				2
Guinea-Bissau	✓				✓				2
Cote d’Ivoire	✓				✓				2
Kenya	✓	✓	✓			✓			4
Lesotho							✓		1
Liberia	✓				✓				2

Table 2. Cont.

Country Name	CEN-SAD	COMESA	EAC	ECCAS	ECOWAS	IGAD	SADC	UMA	Total
Libya	✓	✓						✓	3
Madagascar		✓					✓		2
Malawi		✓					✓		2
Mali	✓				✓				2
Mauritania								✓	1
Mauritius		✓					✓		2
Morocco	✓							✓	2
Mozambique							✓		1
Namibia							✓		1
Niger	✓				✓				2
Nigeria	✓				✓				2
Rwanda		✓	✓						2
Sao Tome and Principe	✓			✓					2
Senegal	✓				✓				2
Seychelles		✓					✓		2
Sierra Leone	✓				✓				2
Somalia	✓					✓			2
South Africa							✓		1
South Sudan						✓			1
Sudan	✓	✓				✓			3
Tanzania			✓				✓		2
Togo	✓				✓				2
Tunisia	✓							✓	2
Uganda		✓	✓			✓			3
Zambia		✓					✓		2
Zimbabwe		✓					✓		2

It is interesting also to observe the geographic dispersion of the members of the different Regional Economic Commissions. This is presented graphically in Figure 3. It can be observed that apart from the ECOWAS countries (with the exception of Cape Verde), which are all also members of the CEN-SAD, there are no other clear common patterns for countries having two or more memberships. This situation creates added complexity when considering common processes in the energy sector and also implies the more important organizational role of the African Union at the continental level.

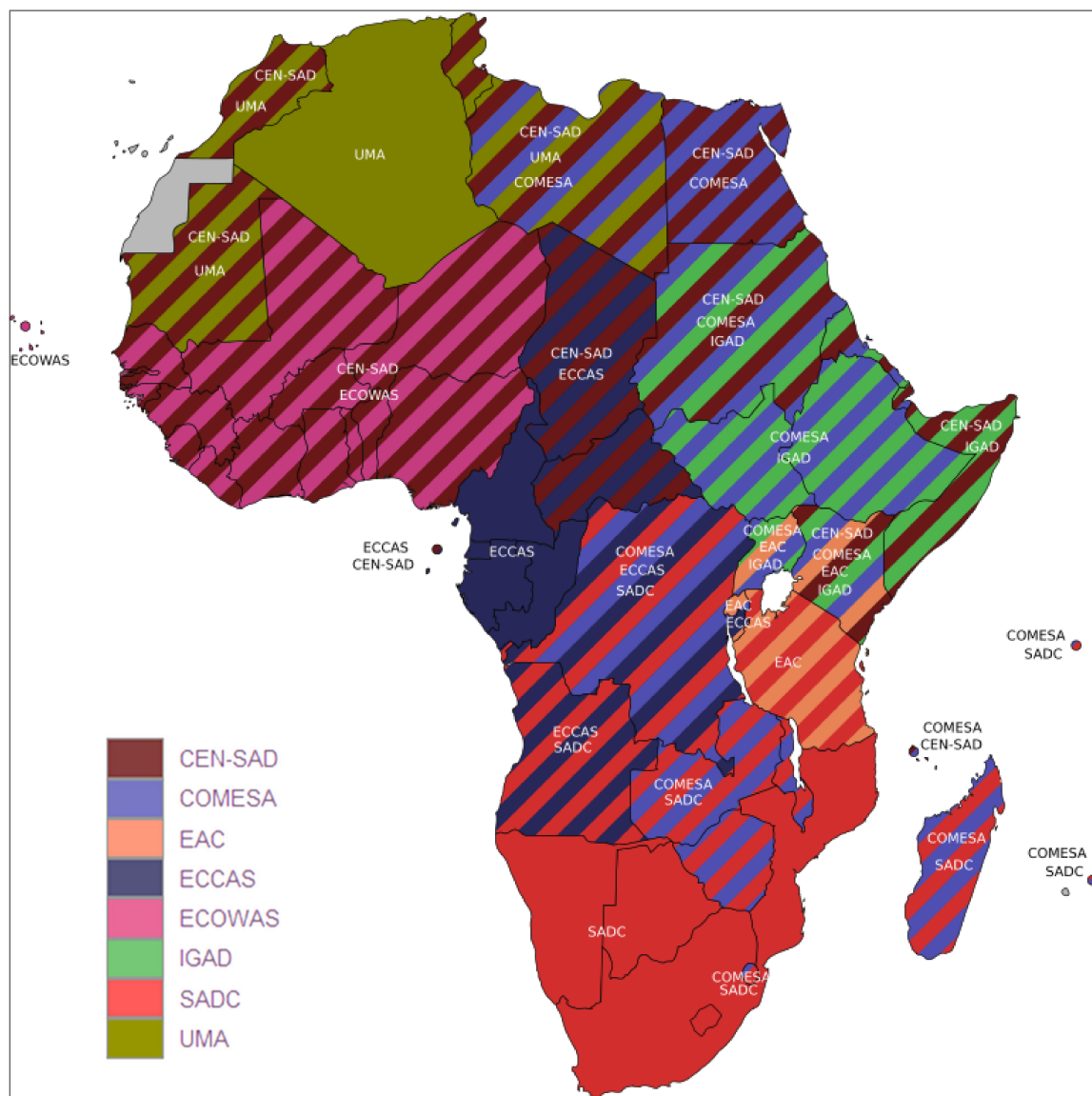


Figure 3. Countries' memberships to Regional Economic Communities (source: the source of the initial svg file under Creative Commons License is Wikipedia).

2.2. Economic Integration

Economic integration is the unification of economic policies between different states, through the partial or full abolition of tariff and non-tariff restrictions on trade. The degree of economic integration can be categorized into seven stages [17]:

1. Preferential trading area
Preferential access to specific products is provided.
2. Free trade area

When at minimum 2 states partially or fully abolish customs tariffs on their inner border a "free trade area" (FTA) is realized. In order to protect against the regional exploitation of zero tariffs, a rule of a certificate of origin originating from the territories of the FTA member states is set.

3. Customs union

A "customs union" is formed when unified tariffs on the exterior borders of the union are introduced.

4. Single market

A single market is a type of trade bloc in which most trade barriers have been removed (for goods) with some common policies on product regulation, and freedom of movement of the factors of production (capital and labor) and of enterprise and services.

5. Economic union

An economic union is a type of trade bloc which is composed of a common market with a customs union. The participant countries have both common policies on product regulation; freedom of movement of goods, services and the factors of production (capital and labor); and a common external trade policy.

6. Economic and monetary union

When an economic union involves unifying currency, it becomes an economic and monetary union.

7. Complete economic integration

Complete economic integration is the final stage of economic integration. After complete economic integration, the integrated units have no or negligible control of the economic policy, including full monetary union and complete or near-complete fiscal policy harmonization.

The major framework for continental integration in Africa is the Treaty Establishing the African Economic Community (Abuja Treaty), which entered into force in 1994 [8]. The integration stages foreseen in this treaty are:

1. *Strengthen existing RECs and establish new RECs in regions where they do not exist (by 1999);*
2. *Ensure consolidation within each REC (gradual removal of tariff and non-tariff barriers) and harmonization between the RECs (by 2007);*
3. *Establish free trade areas and customs unions in each REC (by 2017);*
4. *Coordinate and harmonize tariff and non-tariff systems among the RECs with a view to creating a continental customs union (by 2019);*
5. *Create the African Common Market (ACM) (by 2023);*
6. *Establish an African Economic Community, including an African monetary union and a Pan-African Parliament (by 2028).*

The current status of regional integration by RECs is presented in Table 3 [18].

Currently, most RECs are in Stage 3 or have started the process for realizing Stage 4. One of the major failings of the Abuja Treaty was the proliferation of RECs and the overlapping REC memberships [19]. The “Boosting Intra-African Trade” (BIAT) decision limited the recognized RECs to eight and attempted to consolidate COMESA-EAC-SADC. In addition, it re-envisioned continental integration from a merging of sub-regional customs unions to a merging of free trade areas. The major failing of the BIAT decision was that the RECs were preserved rather than consolidated [19].

Table 3. Progress of regional integration by each REC.

REC	Free Trade Area	Customs Union	Single Market	Freedom of Movement Protocol	Economic and Monetary Union
EAC	✓	✓	✓	3/5 countries	X
COMESA	✓	X	X	Only 2 countries	X
ECOWAS	✓	✓	X	All countries	X
SADC	✓	X	X	7/15 countries	X
ECCAS	✓	X	X	4/11 countries	✓
CEN-SAD	X	X	X	Unclear	X
IGAD	X	X	X	No protocol	X
UMA	X	X	X	3/5 countries	X

Source: [18].

Eventually, instead of merging the REC free trade areas (FTA), it was decided to cast a single FTA over the African continent. The focus was on utilizing integration as a means to economic diversification, structural transformation and development. The Africa Continental Free Trade Area (AfCFTA) has as its objectives to [20]:

- *create a single market, deepening the economic integration of the continent;*
- *establish a liberalized market through multiple rounds of negotiations;*
- *aid the movement of capital and people, facilitating investment;*
- *move towards the establishment of a future continental customs union;*
- *achieve sustainable and inclusive socio-economic development, gender equality and structural transformations within member states;*
- *enhance competitiveness of member states within Africa and in the global market;*
- *encourage industrial development through diversification and regional value chain development, agricultural development and food security;*
- *resolve challenges of multiple and overlapping memberships.*

Table 4 presents a six-step roadmap in order to transition from the AfCFTA to the African single market (ASM) [19]. The six steps are mirrored by the Abuja Treaty, but this is a way to overcome the delays in realizing customs unions in several RECs without waiting for all the RECs to achieve that. This way, the customs union is divided into its two constituent parts: a free trade area and a common external tariff. The third step of the AfCFTA is utilized as a means to the consolidation of a unified free trade area in Africa. After this is achieved, in step 4, a common external tariff is employed in Africa in order to form the African continental customs union with residual tariffs remaining.

Table 4. AfCFTA to ASM in 6 steps.

1	2	3	4	5	6
AfCFTA with REC FTAs as islets of deeper integration	Fully liberalized AfCFTA	Merger of all African FTAs	African continental customs union	African common market	African single market
Achieved by the AfCFTA in its current form	Liberalization under the AfCFTA is deepened until all trade is liberalized	REC FTAs are subsumed as the AfCFTA reaches 100% liberalization. Competing tariff concessions and rules of origin are phased out. REC customs unions are maintained	REC customs unions are subsumed with a continental common external tariff	Freedom of capital, labor and services are achieved, building on the AfCFTA	Deep economic harmonization

Source: [19].

In 2015, the decision was made to forward AfCFTA, and in just under 3 years, protocols on trade in goods, trade in services and on rules and procedures on the settlement of disputes were concluded. The agreement has been signed by 54 members since 2018, and only one year later the threshold foreseen for ratification has been reached (22 countries) and the agreement has entered into force. AfCFTA was launched on the 3rd of June 2021. Energy services are one of the “priority service sectors” for liberalization in the AfCFTA. Essentially, this paves the way for opening up the markets and the implementation of harmonized electricity regulatory frameworks for continental cooperation in this sector.

Concluding this section, electricity trade on a continental scale can be facilitated under the AfCFTA and the continental market realization to be accelerated. Further to the actual electricity trade, the local manufacturing of equipment (e.g., transformers and cables) and trading on the continent can further facilitate the growth of the African electricity grids and decrease reliance on imported equipment, while decreasing costs for both new grid deployment and maintenance and upgrades of existing ones.

3. Institutional Framework for the Electricity Sector in Africa

3.1. Continental Level

- **African Union Commission (AUC)**

At the continental level, the AUC is responsible for the administration and coordination of AU activities and meetings, and its structures are key organs for achieving the AU's objectives, including those on energy. There is a dedicated department in the AUC of Infrastructure and Energy (DIE) with three divisions focusing on Energy, Information Society and Transport and Tourism. The AUC-DIE's mission is to promote collective efforts, at the sub-regional, regional and continental levels, for the accelerated development of infrastructure and energy sectors with a view to enhancing the growth and integration of African economies [21].

- **AU Specialized Technical Committee (STC) on Transport, Energy and Tourism**

Specialized Technical Committees (STCs) are specialized committees responsible for the detailed consideration of thematic areas where AU members have shared interests. The main objective of the STCs is to collaborate closely with commission departments, thus ensuring the harmonization of AU projects and programs and to coordinate with the RECs. In February 2009, the Assembly decided (Assembly/AU/Dec.227(XII)) on a structure of 14 STCs in various thematic areas. One of these STCs covers "Transport, transcontinental and interregional infrastructures, energy and tourism" (STC-TTIET). STC-TTIET also hosts sub-committees, with the Sub-Committee on Energy comprised of the Energy Ministers of the AU.

- **African Union Development Agency–New Partnership for Africa's Development (AUDA–NEPAD)**

NEPAD was established in 2001 and adopted by the African Heads of State and Government at the 37th Ordinary Session of the Organization of African Unity (OAU), which in 2002 was succeeded by the African Union. In the inaugural summit, it was adopted as a program. In 2010, NEPAD was fully integrated into AU structures and processes and became the Planning and Coordinating Agency for NEPAD. In 2018, the AAU summit decided to transform it into the first development agency of the AU with the main mandate to fast-track the realization of Agenda 2063. The main mandate of the AUDA-NEPAD is to facilitate and coordinate the implementation of continental and regional priority programs, develop partnerships and projects and to mobilize resources and partners towards their realization. Further to that, AUDA-NEPAD is tasked with the coordination of research and knowledge management, the monitoring and evaluating of the implementation of programs as well as advocating on the AU vision, mission and core values. AUDA-NEPAD is supervising the implementation of the Program for Infrastructure Development in Africa (PIDA) Priority Action Plan I & II (PAP) and the implementation of the African Continental Power Systems Master Plan.

- **African Development Bank (AfDB)**

The AfDB was established in 1964 as a multilateral development finance institution to contribute to the socio-economic development of the African states. The status of the Bank as the continental development bank is enshrined in the AU Constitutive Act.

The Bank's stated objective is to "spur sustainable economic and social progress in its regional member countries", and thereby contribute to poverty reduction. Its members include 55 African states and 27 non-African states. The Bank has been involved in several continental energy initiatives. These include the Program for Infrastructure Development in Africa (PIDA) aimed at enhancing Africa's "Integration, Connectivity and Competitiveness", the New Deal for Energy in Africa for addressing the continent's energy problems; and hosting the SE4LL Africa Hub to coordinate and facilitate the SE4LL initiative on the continent in accordance with the resolution of the Conference of Energy Ministers of Africa (CEMA) in November 2012.

- **African Energy Commission (AFREC)**

The African Energy Commission (AFREC) is a specialized energy agency of the AU aiming to lead the development of energy policies and programs, create and continuously update the African Energy Statistics, mobilize technical and financial support for member states and implement capacity building programs. AFREC's mandate is implemented through six (6) main broad programs/thematic areas which form part of its new strategy, namely:

- The Energy Information System (AEIS)
- Energy Efficiency
- Bioenergy
- Oil and Gas
- Energy Transition

- **UN Economic Commission for Africa (UNECA)**

Established in 1958 as one of the five regional commissions, its objective is to promote the economic and social development of member states, foster regional integration and promote regional cooperation. One of its thematic areas of focus is regional integration and trade. Consisting of 54 member states, the ECA is both a branch of the UN as well as an important partner as it is well-positioned and provides critical contributions to address the continental development challenges. Among other functions, it gives special attention to up-to-date policy research and advocacy in its continental advisory role. Further to the above, UNECA has taken up the task of collecting and updating original regional statistics, which can be used as a basis for:

- its policy research and advocacy on clear objective evidence;
- promoting consensus on policy;
- providing meaningful capacity development;
- providing advisory services.

- **Africa Forum for Utility Regulators (AFUR)**

AFUR was established in November 2001 as a formal association of national regulators. Its objectives derive from Clause 110 of the NEPAD Framework Document which recognizes the establishment of AFUR and the regional regulatory associations. The objects include active assistance towards effective regulation through facilitating harmonization and sharing lessons among regulators in addition to capacity building.

- **Association of Power Utilities in Africa (APUA)**

Launched in 2012, APUA is a club of chief executives and managing directors of the power utilities responsible for the generation, transmission and distribution of electrical power in Africa. Formerly known as the Union of Producers, Transporters and Distributors of Electricity in Africa (UPDEA), it was first established in 1970 to facilitate, through cooperation and joint efforts, the accelerated provision of electricity services to their people. Headquartered in Abidjan, the organization boasts of a membership of 53 utilities from a total of 43 countries across the continent. The re-launch in 2012 was to help the organization re-focus on its objective and also improve governance. APUA is also coordinating the forum of the power pools.

- **African Electrotechnical Standardization Commission (AFSEC)**

AFSEC was established in 2008 as a subsidiary body of AFREC, to promote everything related to electro-technical standardization aiming to support the electro-technical industrialization of Africa. AFSEC is part of the Pan-African Quality Infrastructure (PAQI) initiative under the AUC Department of Trade and Industry along with the African Accreditation Cooperation (AFRAC), the Intra-Africa Metrology System (AFRIMETS) and the African Organization for Standardization (ARSO).

3.2. Regional Level

At the regional level there are mainly four types of institutions present:

- Power Pools
- Regional Regulatory bodies
- Regional Regulatory Associations
- Regional Renewable Energy and Energy Efficiency Centres

3.2.1. Power Pools

There are five power pools covering all of Africa acting as specialized agencies of their respective RECs:

- **Central African Power Pool (CAPP)**

CAPP was established in 2003 and granted the mandate as a specialized agency of ECCAS. Its objective is to increase access to electricity and improve the regulatory framework and contractual arrangements for electricity trade within the ten member states: Angola, Burundi, Cameroun, Central-African Republic, Chad, Congo, DRC, Gabon, Equatorial Guinea and Sao-Tome and Principe.

- **Maghreb Electricity Committee (COMELEC)**

This power pool had early origins. In 1972, the North African utilities of Morocco, Algeria and Tunisia were interconnected. They created COMELEC, which was later joined by Libya and Mauritania. With the advent of UMA in 1987, the REC adopted the existing power pool as a specialized agency. It must be noted that this power pool has planned to be interconnected and trade with Europe through the Morocco–Spain (existing) and Tunisia–Italy interconnections.

- **East African Power Pool (EAPP)**

This power pool was established in 2005 and formalized in November 2006. It is a specialized agency of COMESA and is headquartered in Addis Ababa, Ethiopia. Its main objective is “the optimum development of energy resources in the region and to ease the electricity power supply to all people of the countries in the Eastern African Region through the regional power interconnections”. Membership: Burundi, Djibouti, DRC, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda. EAPP provides the classic case of members belonging to more than one power pool.

- **Southern Africa Power Pool (SAPP)**

SAPP was established in 1995 as a specialized institution of SADC and it is governed by the SADC Protocol on Energy. It has advanced in its operations, having in place market rules and a well-defined mechanism for system operation as well as a mechanism for market monitoring and surveillance.

The members are Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

- **West African Power Pool (WAPP)**

WAPP was created in 1999 as a specialized agency of ECOWAS with the objective of improving the energy supply, integrating national power systems and facilitating cross-border trade in electricity. Subsequent to its establishment, the ECOWAS Energy Protocol of 2003, which among others promotes the free movement of energy services, further reinforced its mandates. Of the 15 ECOWAS member states, 14 belong to the power pool. These countries are Benin, Burkina Faso, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

3.2.2. Regional Regulatory Bodies

Essentially, regional regulatory authorities are responsible for regulating electricity trade in the power pools.

- **ECOWAS Regional Regulatory Authority (ERERA)**

This regional regulatory body was established under an ECOWAS Supplemental Act as a specialized body of the REC to oversee the development of the cross-border electricity trade, establish technical standards and aid in the harmonization of legislation and regulatory practices, among others. Its existence is backed by law, and it has powers of enforcing its decisions.

- **Independent Regulatory Board (IRB) of EAPP**

This organization was conceived as regional regulatory body for the EAPP, having been established by the Council of Ministers of the pool on 20 March 2012 in Addis Ababa, Ethiopia. The IRB is still in its formative process, and its establishment is yet to be formalized. The secretariat of the organization is currently being hosted by the EAPP.

3.2.3. Regional Regulatory Associations

The regulatory associations exist to facilitate regional regulatory cooperation, to support capacity building and information sharing and to facilitate the integration of the electricity systems. As is expected, many countries participate in multiple organizations, while at the same time some countries participate in none.

- **Energy Regulators Association of East Africa (EREA)**

EREA was established in 2008 by a Memorandum of Understanding among East African regulatory bodies. In 2014, it adopted a constitution and was duly registered in Tanzania, where it is hosted by the water and electricity regulator, EWURA. Its main role is to harmonize energy policies laws and regulators' technical standards and codes of practice and to improve the capacities concerning regulation in the region. EREA's objectives are to *"strengthen economic, commercial, social, cultural, political, technological and other ties for fast balanced sustainable development within the East African Region"*.

In summary, its primary focus is to pool expertise in regulatory matters and facilitate the development of good policies and legislation on energy regulation in line with international trends and good regulatory practices. It also seeks to promote cooperation in energy planning, sustainable energy projects and a harmonized market structure. Being a voluntary association of national regulators, the status of EREA is an advisory body.

- **Regional Electricity Regulators Association (RERA)**

RERA was established by SADC as a national regulators' association in July 2002. Its mission is to facilitate the harmonization of regulatory policy, legislation, standards and practices and to provide a platform for effective cooperation among energy regulators within the SADC region. Being a voluntary association of regulators, it operates in an advisory capacity. RERA is planned to be transformed from an association to the regulatory authority of SADC.

- **Regional Association of Energy Regulators for Eastern and Southern Africa (RAERESA)**

RAERESA is an association of regulatory agencies in the COMESA region. The mission and objectives of the association as set out in its constitution can be summarized as: capacity building and information sharing; development of energy sector policy and regulatory guidelines; and fostering inter-regional cooperation in energy regulatory matters.

- **Association of West Africa Utility Regulators (AWAUR)**

The Association of West African Utility Regulators was created in March 2007 under the West African Power Sector Regional Regulation Project but has yet to become operational.

3.2.4. Regional Renewable Energy and Energy Efficiency Centers

The United Nations Industrial Development Organization (UNIDO) has spearheaded the development of regional centers of renewable energy and energy efficiency. The regional sustainable energy centers aim to accelerate the energy and climate transformation

by creating economies of scales, equal progress and spill-over effects between countries. The regional renewable energy and energy efficiency centers in Africa are as follows:

- The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE);
- The Regional Centre for Renewable Energy and Energy Efficiency (RCREEE);
- The SADC Centre for Renewable Energy and Energy Efficiency (SACREEE);
- The East Africa Community Centre for Renewable Energy and Energy Efficiency (EACREEE);
- The Centre for Renewable Energy and Energy Efficiency for Central Africa (CEREEAC).

It has to be noted that RCREEE is an organ of the Arab League of States, and as such has members also in the Middle East. CEREEAC is the newest one, and was officially established in June 2021.

4. Harmonizing the Electricity Market in Africa and the Development of the African Single Electricity Market

In the middle of the 2010s, PIDA was advancing in developing electricity interconnection projects across Africa. In 2011, the publication of the PIDA study on growth and demand took place, providing a macro-outlook for infrastructure demand including energy. In 2012, the AU Summit adopted PIDA. Until 2015, many activities targeting communication and financing were undertaken including the launch of the Virtual PIDA Information Centre (<https://www.au-pida.org/>, accessed on 15 July 2022), the African Strategic Infrastructure Initiative, the launch of the Africa 50 Fund, the launch of the Continental Business Network and the organization of the Dakar Financing Summit. In 2015, the first PIDA week took place, which also hosted the first PIDA Steering Committee Meeting [22].

While the activities on the infrastructure front were considerable, including power interconnector projects, the question remained on how electricity trade would be realized, especially between power pools, when the interconnectors became operational. With the assistance of the EU through its Technical Assistance Facility for Sustainable Energy (EU TAF), AUC-DIE in 2015 commenced the development of the “Strategy for the Development of a Harmonized Regulatory framework for the Electricity Market in Africa” and the “Action Plan for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa”. The development of these documents included specific implementation steps:

1. Extensive consultation in numerous rounds with all continental and regional African electricity stakeholders;
2. Adoption of the documents by the African electricity stakeholders;
3. Forwarding the documents to the STC-TTIIET;
4. Adoption of the documents by the Sub-Committee on Energy of the STC-TTIIET (Ministers of Energy of the African Union) and adoption by the STC-TTIIET;
5. Forwarding of the documents to the AU Summit;
6. Adoption of the documents by the Heads of State and Government of the AU.

After their adoption, these two documents became the blueprint for the electricity market harmonization activities across the African continent.

Harmonizing electricity markets is crucial since it can result in achieving the following benefits [23]:

- *Contribute to the long-term stability of the electricity sector and facilitate investments at all levels (continental–regional–national);*
- *Facilitate and help grow cross-border trading and power pooling;*
- *Contribute to achieving SDG 7;*
- *Support the effective deployment of continental initiatives and develop fertile ground for the evolution of grid regulation, electricity market design and operation;*
- *Facilitate the sharing of best practices and lessons learned among the African electricity stakeholders and beyond;*
- *Develop a transparent tariff methodology and support the achievement of cost-reflective tariffs;*

- *Improve the monitoring and enforcement of quality of service;*
- *Set the minimum requirements, general principles and rules for the effective and efficient operation of the electricity supply industry (generation, transmission, distribution and sales) facilitating competition;*
- *Support the realization of non-discriminatory third-party access rules for the electricity distribution and transmission grids;*
- *Pave the ground for structural reforms in the electricity markets and facilitate the*
- *Functional unbundling of utilities;*
- *Present through robust arguments the need for countries to establish regulatory authorities meeting the minimum requirements of operational, organizational and financial independence.*

The vision of the strategy for the harmonization of the regulatory frameworks for the electricity market in Africa, is “to achieve a fully integrated, competitive and harmonized electricity market in order to accelerate Africa’s development and improve access for the benefit of African citizens” [23]. The purpose of harmonizing the regulatory framework for the electricity market in Africa is “to accelerate the transformation of the sector, which is a potential catalyst for stimulating the desired socioeconomic development and poverty reduction, by creating an enabling environment for facilitating trade and investment. It entails the adoption of common rules for the development of both internal and external markets and the creation and strengthening of regulatory institutions so as to oversee the developments in the sector at the national and regional levels. It will also involve resourcing and strengthening the executive and coordination roles of the sector continental bodies and positioning them to ensure that the implementation of decisions and guidelines issued at the continental and regional levels are given legislative effect so as to create binding obligations on the regional and national levels, in particular the Regional Economic Communities (RECs) and their member states” [23].

Six strategic objectives were identified [23]:

1. *Developing effective regional and continental electricity markets;*
2. *Improve the operational efficiency and performance of the electricity supply industry;*
3. *Create stable, transparent and predictable environments to attract investment;*
4. *Enhance electricity markets’ frameworks to increase access;*
5. *Enhance renewable energy frameworks;*
6. *Establish norms, standards and frameworks for energy efficiency.*

The EU remained the core partner of the AUC-DIE in the following years, actively supporting the implementation of the action plan. As the impact of the results became evident, the AUC-DIE set the foundations for the African Single Electricity Market. The AfSEM, as an overall electricity initiative of the AU, covers strategic policy and planning aspects of the whole electricity value chain that relate to generation, transmission, distribution and end-use, at all three levels (continental, regional and national). The AU STC-TTIIET Cairo Declaration requested the AUC, together with all relevant Pan-African continental and regional institutions, to operationalize the electricity market in Africa. Already, the Policy Paper and Roadmap for AfSEM have been validated by the STC-TTIIET on 26 November 2020. AfSEM was launched on 3 June 2021, paving the way to the largest electricity market in the world covering a population of more than 1.3 billion. A phased approach has been adopted, with the first one planned to be finalized by 2023, with full operation set for 2040. The main objective is to harmonize regulatory frameworks and integrate generation, transmission and distribution masterplans across the continent. The AfSEM is expected to also enable the diversification of energy sources, in line with the Continental Energy Transition Strategy, allow better trade and investment exchanges’ leveraging of the AfCFTA and ultimately lead to 100% electricity access by 2030 [24].

At the same time, AUDA-NEPAD has commenced work towards the development of the African Continental Power Systems Masterplan (CMP). The decision to develop a Continental Transmission System Masterplan was made by the Africa energy ministers during the AU STC-TTIIET, held in Nouakchott and Cairo in 2018 and 2019, respectively. At that meeting, the African Union Development Agency (AUDA-NEPAD) was tasked to lead the development of the masterplan. Under the coordination of the EU’s Technical Assistance

Facility and through partnering with the International Renewable Energy Agency (IRENA) and the International Atomic Energy Agency (IAEA) for the modeling exercise, the first phase is already under way [25].

The CMP is expected to integrate the vision of the AU as expressed in various STC and ministerial meetings, as well as the following: the AfDB New Deal for energy in Africa, the concept of clean corridors and several other continental strategic issues such as (a) The Geothermal Risk Mitigation Facility; (b) The Program on Bioenergy Development in Africa; (c) The Harmonized Continental Policy and Regulatory Frameworks in the Electricity Sector; and (d) the Green Mini-Grids (GMGs) Africa Strategy. It is further expected that the CMP will facilitate the creation of a continental energy market which is anchored on the five power pools and driven by well-functioning regional electricity markets.

5. Increasing Electricity Access under AfSEM

In total, 584 million Africans still do not have access to electricity [1]. This is a number that has increased for the first time since 2015 due to the COVID-19 pandemic [26]. Achieving SDG 7 of universal access to electricity is at the core of all efforts, and fully aligned with Agenda 2063 [27]. In order to provide access to electricity, there are mainly three options. The first is to interconnect these populations with the main grid through grid extension, the second is to deploy autonomous mini-grids and the third is to provide small autonomous systems in the form of solar home systems [28]. While the first option appears to be the most preferable one, it is the most expensive solution, followed by mini-grids and solar home systems. As a result, grid extension is expected to be the chosen solution only for urban and peri-urban locations as well as areas under new high voltage interconnectors. Most people without access to electricity live in rural areas, and for them it is expected that electrification will come with mini-grids [29]. Solar home systems are used in the short-term to bring people out of darkness, and in the future will only serve the niche of very low population density areas. Understanding this situation, one of the strategic objectives of the Strategy for a Harmonized Electricity Market in Africa was “Enhancing electricity markets frameworks to increase access”. Specific activities were deployed by the AUC in collaboration with the EU’s Technical Assistance Facility and USAID in order to set the ground. These activities resulted in the following documents:

1. Guidelines for Institutional and Policy Model for Micro-/Mini-Grids [30].
2. Unlocking Africa’s Mini-Grid Market [31].
3. Exploring Africa’s Mini-Grid Tariff Methodology Assessment [32].

Further to these documents, the Strategy for Smart Distribution Grids [33] provides the provisions made for integrating off-grid electrification to the main grid in the medium to longer term as interconnected micro-grids. This is crucial, since huge amounts of financing will have been spent in off-grid electrification and these assets cannot simply be discarded when the main grid encompasses these installations in the future. At the same time, the AfDB is deploying the Africa Mini-Grid Market Acceleration Programme, which is providing technical assistance to expand private mini-grid investment on the African continent [34].

6. Lessons Learnt and Recommendations on the Way Forward

When the development of the first two core high-level harmonization documents—the strategy and action plan—began in Autumn 2015, representatives of all the continental and regional organizations of the energy sector were meeting for the first time. Additionally, for the development of these high-level documents, their active participation and input were crucial, since at the end of the day the outcome would have to be adopted by 55 heads of state and governments. The three physical meetings that took place had many positive side impacts as well. People working in comparable organizations around the continent had the chance to exchange experiences and lessons learnt and new collaborations to form.

After the adoption of the action plan, specific activities foreseen in it were brought forward for implementation. Four main topic/streams of activities can be identified, i.e.,

transmission grids, energy efficiency, energy access and horizontal tasks, as well as some cross-cutting activities as presented in Table 5. As the work progresses, more specialized topics will be analyzed and addressed.

Table 5. Activities at the continental level implemented so far.

Transmission Grids	Energy Efficiency	Energy Access	Horizontal Tasks
T.1. Guidelines for Transmission Tariffs at Continental Level and Monitoring Plan for Transmission Tariffs at Continental Level	E.1. Continental MEPS and Labels Guidelines	A.1 Guidelines for Institutional and Policy Model for Mini-Grids at Continental Level Including Model Contracts	H.1 Strategy for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa
T.2. Tariff Computational Model and Transmission Tariff/Wheeling Charge Results	E.2. Monitoring of the Implementation of the Minimum Energy Performance Standards (MEPS) and Energy Labeling	A.2. Unlocking Africa's Mini-Grid Market	H.2. Action Plan for the Development of a Harmonized Regulatory Framework for the Electricity Market in Africa
T.3. Capacity Building and Training on Transmission Tariffs Calculation Tool	E.3. Road Map Strategy and action Plan for Creation and Operationalization of Test Laboratories	A.3. Exploring Africa's Mini-Grid Tariff Methodology Assessment	H.3. Design of the African Single Electricity Market–Policy Paper and Roadmap
T.4. Strategy and Roadmap for Evolving the Distribution Grids to Smart Grids	E.4. Market Surveillance Strategy and Action Plan		H.4. Preparatory Actions for APUA and its Electricity Supply Industry Members Towards the AfSEM
T.5. Development of the African Continental Power Systems Master Plan (ongoing)	E.5. Strategy and Roadmap for Establishing a Market for Energy Efficient Appliances in Africa		H.5. Policy Guidelines for Competitive Procurement Processes
C.1. Continental Guidelines and Strategies for Reducing and Maintaining Electricity Network Losses			H.6. African Union Post-COVID-19 Recovery Strategy for the African Energy Sector along with its Implementation Action Plan and M&E Framework
	C.2. Guide for Application of Standards for Appliances used in Rural Electrification Systems in Africa		H.7. Strategic Planning, Action Plan and Guidelines for the African Single Electricity Market (ongoing)

While all energy stakeholders need to be actively involved especially in the horizontal tasks in all development steps, in other more specialized activities, a smaller number of the institutions needs to be actively involved in all steps of the development. This, on the other hand, does not mean that specialized activities need to be developed in silos. Consultation workshops need to take place, and this has challenges concerning cost, environmental footprint since the stakeholders are located all around the continent and need to travel, as well as logistics issues for having more than 50 people in the same room. The process followed as presented in Section 4 requires the validation from all stakeholders in order to be forwarded to the next step. During the COVID-19 pandemic, the consultation workshops were realized virtually with benefits and challenges.

Some recommendations include:

- Hybrid events need to be utilized to minimize excessive physical trips especially for intermediate consultations.
- One physical workshop per year can provide extra benefits to the whole process and is recommended to be organized.

- As activities become more specialized, in the intermediate development steps, the more relevant stakeholders can be more active.
- Organization of consultation workshops alongside other activities such as the PIDA week can minimize costs and logistic challenges.

7. Discussion

Africa is a huge continent. Despite the size, efforts for continental organization started in the late 1950s, with the forming of the Africa Day, followed by the Organization of African Unity and the African Economic Community, all leading to the founding of the African Union. A big ongoing discussion for many years now has been taking place regarding where to put a greater effort: the integration of the continent as a unit, or the integration of the sub-regions of Africa. The Abuja Treaty set the ground for the RECs as the basis of African integration. As was presented above, multi-membership in different RECs and various institutions expanding in different RECs create organizational and administrative challenges. The current example, though, of the AfCFTA shows that activities through the RECs can be accelerated with targeted continental action. The AfSEM is another example of how the African Union wants to accelerate the integration of the different power pools forming an interconnected African grid. This is especially important to enable not only inter-country trade between African countries, but also cross-continental electricity trade with Europe and Asia. AfSEM will greatly facilitate the socio-economic development of the continent based on the available renewable energy resources. This is also fully in line with the “African Common Position on Energy Access and Just Transition”, which was adopted in July 2022 and reaffirms the goals of universal access to energy and ensuring the energy security for the African continent, while strengthening its resilience in acting in a responsible manner towards the planet.

This paper aimed to present the challenges faced in the harmonization of the electricity markets in Africa due to the complexities of political continental integration as well as economic integration. It is one of the few efforts that have aimed to present in a single document the institutional framework of the electricity sector in Africa and how these institutions collaborate to form and deploy policies at the continental and regional levels, affecting, of course, the deployment of policies at the national level. A graphic representation of the institutional framework in Africa in all three levels is presented in Figure 4. All these institutions need to synergize effectively both at continental and regional levels in order to have concrete steps forward at the national level as well. This multitude of institutions highlights the challenges faced, but also gives value to the achievements that have already been accomplished, with the latest being the launch of the AfSEM and the implementation of the first phase of the CMP.

Moreover, as more activities are deployed in parallel towards the full operationalization of AfSEM, the recommendations presented in Section 6 can help overcome challenges and accelerate progress. The gist of the recommendations is that all stakeholders need to be fully informed for all developments in relation to AfSEM, but at the same time, during the intermediate development steps, the institutions more relevant to each activity can be more involved. Ownership of the work produced is extremely important.

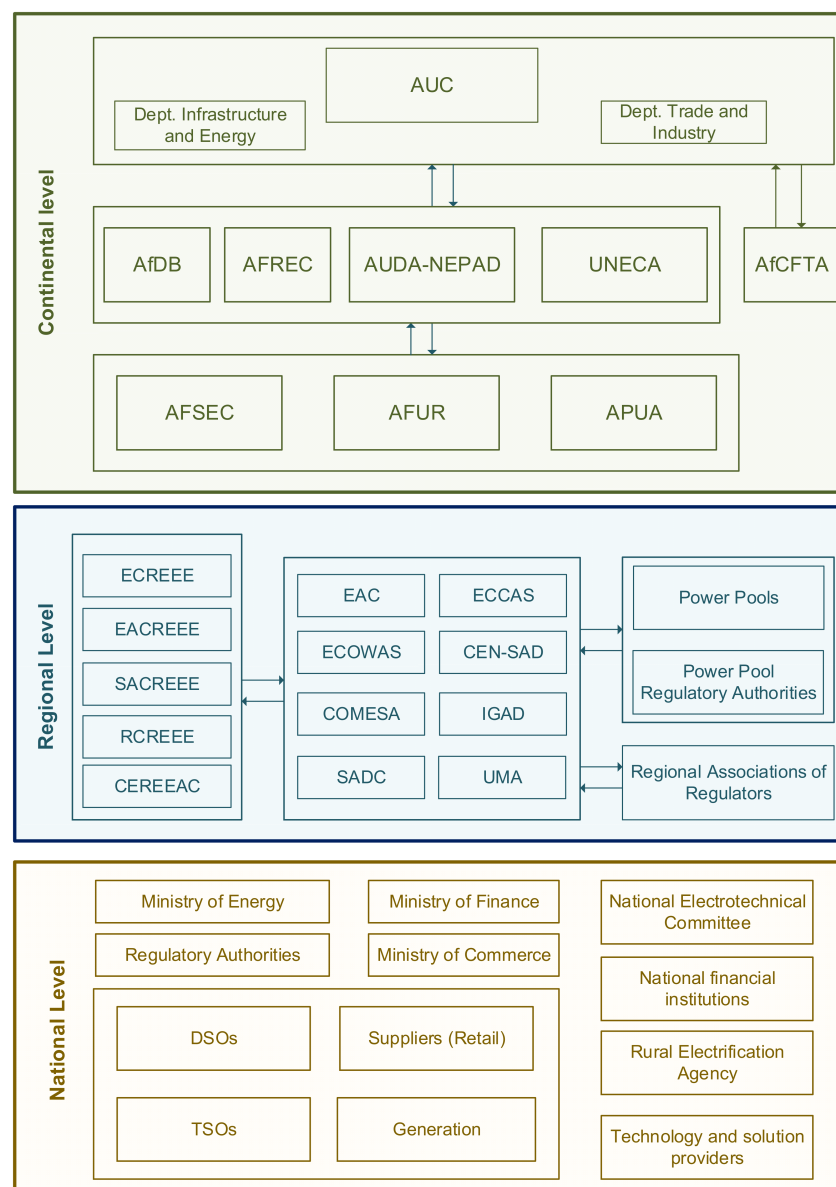


Figure 4. Visual overview of the institutional framework of the electricity sector in Africa.

8. Conclusions

AfSEM is a major step forward for the African electricity sector. The African Union, with the help of the European Union, has set the basis and taken concrete steps since 2016, when the Strategy and Action Plan for a Harmonized Electricity Market in Africa was adopted by the heads of state and governments of the AU and subsequent activities were deployed. AfSEM will be one of the largest electricity markets around the world, aiming to provide African households, businesses and industries with more secure, sustainable, reliable and affordable energy.

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Abbreviations

AfCFTA	Africa Continental Free Trade Area
AfDB	African Development Bank
AFREC	African Energy Commission
AFSEC	African Electrotechnical Standardization Commission
AfSEM	African Single Electricity Market
AFUR	Africa Forum for Utility Regulators
APUA	Association of Power Utilities in Africa
ASM	African Single Market
AU	African Union
AUC	African Union Commission
AUDA-NEPAD	African Union Development Agency–New Partnership for Africa’s Development
AWAUR	Association of West Africa Utility Regulators
BIAT	Boosting Intra-African Trade Decision
CAPP	Central African Power Pool
CEMA	Conference of Energy Ministers of Africa
CEN-SAD	Community of Sahel-Saharan States
CEREEAC	Centre for Renewable Energy and Energy Efficiency for Central Africa
CMP	African Continental Power Systems Master Plan
COMELEC	Maghreb Electricity Committee
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
EACREEE	East Africa Community Centre for Renewable Energy and Energy Efficiency
EAPP	East African Power Pool
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EREA	Energy Regulators Association of East Africa
ERERA	ECOWAS Regional Regulatory Authority
EU	European Union
FTA	Free Trade Area
GMGs	Green Mini-Grids
IAEA	International Atomic Energy Agency
IGAD	Intergovernmental Authority on Development
IOC	Indian Ocean Commission
IRB	Independent Regulatory Board
IRENA	International Renewable Energy Agency
OAU	Organization of African Unity
PIDA	Programme for Infrastructure Development in Africa
RAERESA	Regional Association of Energy Regulators for Eastern and Southern Africa
RCREEE	Regional Centre for Renewable Energy and Energy Efficiency
REC	Regional Economic Community
RERA	Regional Electricity Regulators Association
SACREEE	SADC Centre for Renewable Energy and Energy Efficiency
SADC	Southern Africa Development Community
SAPP	Southern Africa Power Pool
SDG	Sustainable Development Goal
STC	Specialized Technical Committee
TTIIET	Transport, Transcontinental and Interregional Infrastructures, Energy and Tourism
UMA	Arab Maghreb Union
UN	United Nations
UNECA	UN Economic Commission for Africa
UNIDO	United Nations Industrial Development Organization
WAPP	West African Power Pool

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