

Assessment of ECOWAS Renewable Energy Policies and Development Projects: Progress, Successes, and Challenges

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Abstract

This review paper employed a systematic review of literature (SRL) involving review of policy documents, reports and academic literatures to assess the renewable energy policies and development projects implemented by the Economic Community of West African States (ECOWAS), with a focus on their progress, successes, and ongoing challenges. In response to widespread energy poverty and growing climate concerns, ECOWAS introduced regional strategies such as the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP). These initiatives aim to increase renewable energy penetration, enhance energy efficiency, and support rural electrification across member states. Central to these efforts is the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), which coordinates technical assistance, investment mobilization, and regional policy alignment. Notable achievements include the proliferation of off-grid solar systems, mini-grid developments, and improved regulatory environments in several countries. Progress is also reflected in greater regional cooperation and the attraction of international development partners and private investors. However, challenges remain significant. Key issues include limited access to financing, inadequate technical expertise, regulatory inconsistencies, and infrastructural deficits. Political instability in certain regions and over dependence on external funding further hinder sustainable progress. The study concludes that while ECOWAS has made important advances in renewable energy development, long-term success will depend on stronger institutional frameworks, local capacity building, and increased domestic investment. A coordinated, inclusive approach is essential to ensure energy access and sustainability in West Africa.

Keywords: ECOWAS, Renewable Energy, Energy Efficiency, Solar Systems, Energy Policy, Energy Access

Introduction

Access to reliable, affordable, and sustainable energy remains one of the most pressing development challenges facing West Africa. The Economic Community of West African States (ECOWAS), a regional political and economic union of fifteen West African countries, has taken critical steps toward transforming the region's energy sector by prioritizing

renewable energy as a key driver of socio-economic development, climate resilience, and energy security. In a region where over 50% of the population lacks access to electricity and many rural areas remain entirely off-grid, renewable energy offers an opportunity to leapfrog traditional, fossil-fuel-based infrastructure and achieve inclusive, low-carbon development (MDPI 2023; IRENA, 2020a; World Bank 2021a).

Figure 1 shows that total final energy consumption in the ECOWAS region in 2021 according to source of fuel is dominated by biomass and waste (58.1%). Electricity consumption is very low (0.2 %) and reflects low access to electricity infrastructure in the region. The share of oil products was 33.7%. This implies that dirty fuels accounts for more than 80% of energy use in the region. ECOWAS recognizes that conventional energy systems in the region are unsustainable, with a heavy reliance on expensive and environmentally harmful fossil fuels, weak transmission infrastructure, and limited domestic refining capacities. This situation contributes not only to frequent power outages and high electricity costs but also to elevated greenhouse gas (GHG) emissions and health impacts due to air pollution (UN 2024, IEA, 2022). In response to these challenges, ECOWAS member states have increasingly turned their attention to renewable energy sources such as solar, wind, hydropower, and biomass, which are abundantly available in the region. According to ECREEE (2015), West Africa possesses vast untapped renewable energy potential that, if harnessed efficiently, could meet a significant portion of the region's energy demand while fostering job creation, industrial development, and climate mitigation.

The regional push for renewable energy is embedded in several strategic policy frameworks developed over the past decade. Most notably, the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP), both adopted in 2013, represent landmark commitments by all member states to promote clean energy transitions. The EREP outlines ambitious goals, including achieving 48% of electricity generation capacity from renewable sources and universal access to sustainable energy services by 2030 (ECREEE, 2015). These policy objectives align with global sustainability frameworks, such as the United Nations Sustainable Development Goals (SDGs), particularly Goal 7, which calls for access to affordable, reliable, sustainable, and modern energy for all.

Institutional mechanisms have also been put in place to support policy implementation and regional coordination. The establishment of the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in 2010 was a milestone in fostering a structured and unified approach to renewable energy development in West Africa. ECREEE serves as a technical and advisory body responsible for promoting regional cooperation, mobilizing investments, enhancing capacity building, and facilitating knowledge sharing among member states. Since its inception, ECREEE has collaborated with a range of development partners, including the African Development Bank (AfDB), the United Nations Industrial Development Organization (UNIDO), and the European Union, to support project implementation and institutional strengthening (Sakho et al., 2019).

The progress made thus far by ECOWAS in advancing renewable energy development can be seen in the growing number of regional and national initiatives that have taken root across member countries. Projects such as the Regional Off-Grid Electrification Project (ROGEP), supported by the World Bank, and the West Africa Clean Energy Corridor (WACEC), facilitated by the International Renewable Energy Agency (IRENA), aim to increase access to clean energy through grid expansion, mini-grids, and standalone solar systems (World Bank, 2021b; IRENA, 2020b). Additionally, member states like Senegal, Ghana, and Cape Verde have become regional frontrunners by implementing robust national renewable energy programs that complement regional efforts.

Despite these achievements, ECOWAS continues to face numerous challenges in its renewable energy transition. These include inadequate financing mechanisms, policy and regulatory inconsistencies across countries, insufficient technical capacity, and socio-political instability in certain member states. The overreliance on donor support and external funding has also raised concerns about the long-term sustainability and ownership of renewable energy initiatives (Njie et al., 2021b). Furthermore, the limited integration of renewable energy into national power grids and the absence of effective monitoring and evaluation mechanisms hinder the region's ability to track progress and adapt to emerging trends.

Moreover, while policies have been adopted at the regional level, their translation into actionable national strategies has been uneven. Several ECOWAS member countries still lack comprehensive renewable energy roadmaps, and institutional coordination between national energy agencies and ECOWAS bodies remains fragmented. Capacity constraints, both in terms of skilled human resources and institutional structures, further exacerbate these issues, limiting the speed and scale of renewable energy deployment (IEA, 2022).

In light of these dynamics, a comprehensive assessment of ECOWAS's renewable energy policies and development projects is critical to understanding the region's progress, successes, and ongoing challenges. Such an assessment provides insight into what has worked, where gaps remain, and how regional and international stakeholders can collaborate more effectively to achieve shared energy and development goals. It also contributes to a broader understanding of how regional organizations in Africa can shape clean energy transitions in contexts characterized by energy poverty, institutional fragility, and climate vulnerability.

This review seeks to critically examine the existing body of research on ECOWAS's renewable energy landscape. It aims to evaluate the effectiveness of the policy frameworks in place, analyze the implementation of renewable energy projects, and identify both the successes and bottlenecks that define the region's journey toward a sustainable energy future. The review draws on academic studies, policy reports, and international development documents to provide a balanced and evidence-based overview of renewable energy efforts in ECOWAS member states.

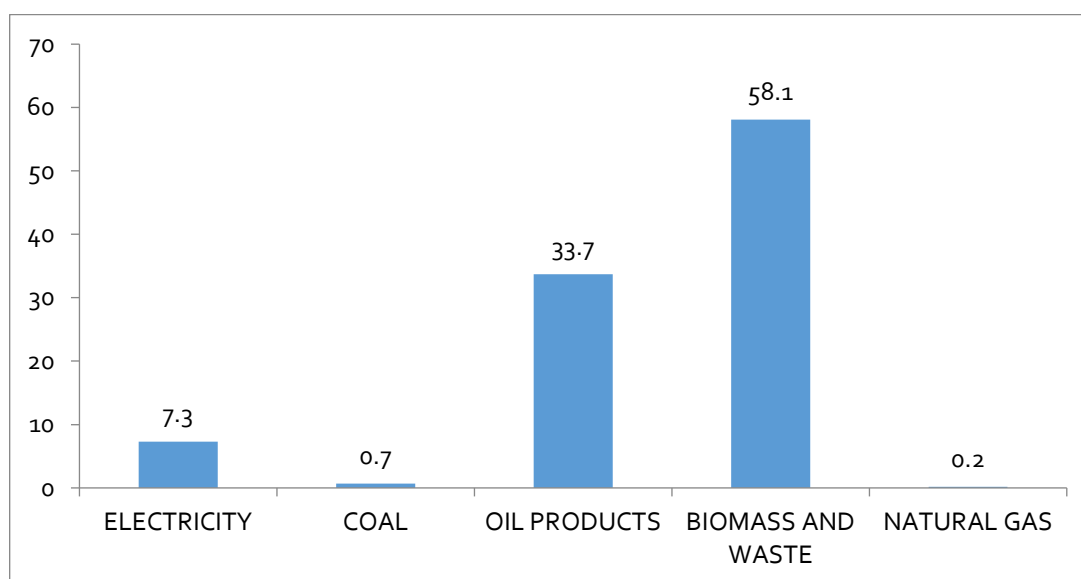


Figure 1. Final Energy Consumption of ECOWAS in 2021

Source: World Development Indicators 2023

Policy Frameworks and Institutional Developments

Over the past two decades, the Economic Community of West African States (ECOWAS) has developed a comprehensive policy and institutional framework to promote renewable energy and energy efficiency across the region. Recognizing the central role of sustainable energy in driving economic growth, reducing poverty, and achieving environmental goals, ECOWAS has actively pursued regional cooperation through harmonized policies and coordinated institutional mechanisms. Some of the key policies and regulatory mechanisms for promoting renewable energy in the region are displayed in table 1. This section provides an in-depth examination of the core policy frameworks, institutional arrangements, and strategic partnerships that underpin renewable energy development within the ECOWAS region.

Table 1. Overview of Key Policies and Regulatory Mechanisms for Promoting Renewable Energy in ECOWAS

Policy/Mechanism	Description	Implementing Body/Status
ECOWAS Renewable Energy Policy (EREP)	Regional framework aimed at increasing access to renewable energy across ECOWAS.	Adopted in 2013; coordinated by ECREEE.
National Renewable Energy Action Plans (NREAPs)	National-level action plans aligned with EREP targets.	Developed by all ECOWAS member states.
ECOWAS Energy Efficiency Policy (EEEP)	Promotes efficient energy use alongside renewables.	Complementary to EREP; adopted region-wide.
Renewable Energy Feed-in Tariffs (REFITs)	Fixed pricing policies to encourage renewable energy investments.	Adopted in Ghana, Senegal, Nigeria, and others.
Net Metering Regulations	Allows renewable energy producers (like solar home systems) to feed energy into the grid.	Varies by country (e.g., Cape Verde, Ghana).
Independent Power Producer (IPP) Frameworks	Legal and regulatory tools for private sector involvement in renewable energy.	Implemented in Nigeria, Senegal, Ghana, and Côte d'Ivoire.
Licensing and Permitting Guidelines	Streamlining approval processes for renewable energy projects.	ECREEE supports harmonization across member states.
Renewable Energy Targets (2030 Goals)	EREP sets a regional goal of 48% renewable energy share in electricity mix by 2030.	Country-specific targets set in NREAPs.
Gender Mainstreaming in Energy Policies	Focus on ensuring inclusive access and gender equity in energy systems.	ECREEE's gender and energy strategy (2018).
Off-Grid Electrification Strategies	Supports mini-grid and standalone systems for rural areas.	Implemented through the ECOWAS Off-Grid Program.

Source(s): ECREEE (2024), ECOWREX (2023),

The ECOWAS Renewable Energy Policy (EREP)

The ECOWAS Renewable Energy Policy (EREP), adopted in 2013, stands as the cornerstone of the region's strategy to increase the penetration of renewable energy in electricity generation and improve access to sustainable energy services. Sustainable energy indicators in the ECOWAS region as depicted in table 1 has revealed that the region is characterized by low clean energy mechanism and electricity infrastructural deficit. The

EREP was formulated to provide a unified direction for ECOWAS member states, guiding national energy strategies while promoting regional harmonization.

Table 2. Some Sustainable Energy Indicators in ECOWAS

	2018	2019	2020	2021
Total Energy supply per capita(toe/Inhabitant)	0.36	0.36	0.38	0.36
Electricity access rate (%)	52.4	54.4	55.8	56.1
Electricity Consumption Per capita (KWh/Inhabitant)	251.8	247.9	255.3	268.6
Average daily consumption of LPG (Kg/Household)	0.11	0.11	0.20	0.32
Share of renewable energy in electricity generation	18.4%	21.0%	20.7%	20.2%
Electrical energy consumption (MWh)	94536	95599	101025	108902
Installed capacity (MWe)	24689.58	25033.66	25092.47	25826.13
Hydroelectricity	5332.10	5332.10	5435.76	5920.32
Solar Photovoltaic	264.96	269.04	274.04	363.79
Tidal/Wave energy, Biomass, etc	15.10	15.10	16.25	17.35
Wind energy	26.00	26.00	26.00	27.25
Conventional and Similar fuels	19051.42	19391.42	19340.42	19497.42

Source: ECOWAS key energy facts and figures 2023(www.eis.ecowas.int.)

The policy sets ambitious targets: by 2030, renewable energy is expected to contribute at least 48% of the total electricity generation capacity, including 25% from large hydropower and 23% from other renewable sources such as solar, wind, and biomass (ECREEE, 2015). In terms of access, the policy aims to provide 100% access to electricity in urban areas and 90% in rural areas through a mix of on-grid and off-grid solutions.

EREP emphasizes the deployment of decentralized energy systems, particularly in rural and peri-urban areas, where grid extension is economically unviable. This approach is crucial given that a significant portion of the region's population—especially in countries like Burkina Faso, Guinea, and Niger—resides in remote areas far from centralized electricity networks (IRENA, 2020b). The policy also promotes the development of national renewable energy action plans (NREAPs), which are country-specific roadmaps aligning national priorities with regional objectives.

A unique feature of EREP is its integrated gender and social inclusion strategy, which mandates member states to develop energy policies that are inclusive, ensuring that women, youth, and marginalized communities participate in and benefit from renewable energy development (SEforALL, 2020). This gender-sensitive approach has been increasingly recognized as essential for achieving equitable energy access and maximizing the socio-economic benefits of renewable energy.

The ECOWAS Energy Efficiency Policy (EEEP)

Complementing EREP, the ECOWAS Energy Efficiency Policy (EEEP) was also adopted in 2013 with the goal of reducing energy consumption and promoting sustainable use. EEEP targets improvements in lighting, cooking, industry, and transport by introducing energy-efficient technologies and practices.

Key objectives of EEEP include:

- Phasing out inefficient incandescent lamps by 2020 (largely achieved in several countries).
- Promoting efficient cook stoves and clean cooking technologies to reduce reliance on biomass.
- Improving electricity distribution efficiency through technical loss reduction.
- Introducing minimum energy performance standards (MEPS) and energy labeling for appliances.

By reducing energy intensity, EEEP is intended to create "megawatts"—the energy saved through efficiency measures—which can be redirected to meet rising demand, particularly in countries with limited generation capacity (UNDP, 2018). Together, EREP and EEEP form a comprehensive policy environment designed to accelerate the energy transition in the region.

Institutional Architecture: ECREEE and Regional Coordination

The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), established in 2010 and headquartered in Praia, Cabo Verde, serves as the technical arm of ECOWAS for renewable energy and energy efficiency. ECREEE plays a central role in policy coordination, capacity building, project implementation, and knowledge dissemination.

ECREEE has several core mandates:

- Assist member states in the development and implementation of NREAPs and National Energy Efficiency Action Plans (NEEAPs).
- Facilitate resource assessments, feasibility studies, and project pipeline development.
- Act as a knowledge hub and training center for energy practitioners and policymakers.
- Coordinate donor-supported programs and partnerships with multilateral institutions.

One of ECREEE's key achievements is the Regional Renewable Energy and Energy Efficiency Status Report, produced periodically in collaboration with organizations such as REN21 and IRENA, which tracks progress across the region. ECREEE also serves as the regional secretariat for the Sustainable Energy for All (SEE for ALL) initiative, aligning ECOWAS efforts with global energy access and sustainability goals (SEE for ALL, 2020).

ECREEE's approach is highly participatory. It actively engages stakeholders across the public and private sectors, civil society, academia, and international organizations. This broad coalition has helped build consensus around policy goals and increase political buy-in at both the regional and national levels (Sakho et al., 2019).

National Renewable Energy Action Plans (NREAPs) and Energy Efficiency Policy

Following the adoption of EREP and EEEP, ECREEE worked with member states to develop NREAPs and NEEAPs. These country-level action plans provide specific implementation pathways for achieving regional targets.

For example:

- Ghana's NREAP targets a 10% share of renewables in its energy mix by 2030, with specific milestones for solar, wind, and biomass.
- Senegal's plan outlines the deployment of solar PV in rural areas and targets 20% renewable energy in the grid.
- Cape Verde, with its ambitious goal of achieving 100% renewable energy by 2030, has developed detailed investment and technology roadmaps, including desalination powered by solar and wind (UNDP, 2018).

The action plans have provided governments with structured frameworks for mobilizing finance, designing incentives, and prioritizing projects. However, implementation has been uneven, with some countries lagging due to limited institutional capacity, lack of coordination, or funding constraints (Njie et al., 2021a).

Development Projects and Implementation

The successful transition to renewable energy in the ECOWAS region hinges not only on policy frameworks and institutional arrangements but also on the implementation of concrete development projects that address energy access gaps, reduce dependence on fossil fuels, and contribute to socio-economic development. Over the past decade, ECOWAS, through its Centre for Renewable Energy and Energy Efficiency (ECREEE), has spearheaded and supported a broad range of renewable energy and energy efficiency projects across the region. Table 3 highlights some of the renewable energy projects at different stages. These projects span grid-connected systems, off-grid and mini-grid solutions, clean cooking initiatives, and capacity-building programs. This section provides an in-depth examination of major renewable energy projects in ECOWAS countries, implementation strategies, financing mechanisms, and the associated challenges and successes.

Table 3. Key ECOWAS Renewable Energy Projects

Project Name	Country	Type	Capacity (MW)	Status	Notes
Mambilla Hydropower	Nigeria	Hydropower	3,050	Planned	One of the largest hydro projects in the region.
Koukoutamba Hydropower	Guinea	Hydropower	294	Planned	Part of Guinea's hydropower expansion strategy.
Grand Kinkon Hydropower	Guinea	Hydropower	291	Planned	Aimed at boosting Guinea's renewable energy capacity.
Bumbuna II Hydropower	Sierra Leone	Hydropower	143	Underway	Expansion of existing Bumbuna facility.
Adjarala Hydropower	Togo/Benin	Hydropower	147	Planned	Joint project between Togo and Benin.
Benkongor I, II, III	Sierra Leone	Hydropower	34.8, 80, 85.5	Planned	Series of projects to enhance Sierra Leone's energy infrastructure.
Solar PV Projects	Various	Solar PV	~15,800	Pipeline	Significant solar capacity planned across the region.
Wind Energy Projects	Senegal (Taiba N'Diaye Wind Farm)	Wind	420	Installed	Wind projects under consideration in other member states.

Sources: (1) ECREEE (2024), www.ecreee.org (2) ECOWREX (2024), <https://ecowrex.org>

Regional Flagship Projects

The Regional Off-Grid Electrification Project (ROGEP)

One of the most significant regional projects under implementation is the Regional Off-Grid Electrification Project (ROGEP), funded by the World Bank and supported by ECREEE. Launched in 2017, ROGEP targets 19 countries across West and Central Africa, including all ECOWAS member states, with the aim of expanding access to electricity through standalone solar systems.

ROGEP's objectives include:

- Supporting 1.7 million households, enterprises, and public institutions with off-grid solar solutions.

- Creating a sustainable ecosystem of local solar businesses.
- Improving the enabling environment for private investment in off-grid markets (World Bank, 2021).

The project provides technical assistance, business development support, and results-based financing to solar companies. It also fosters cross-border collaboration by harmonizing technical standards and supporting regional supply chains for solar equipment. ROGEP is a landmark in demonstrating how regional coordination and donor funding can catalyze decentralized energy access solutions.

ECOWAS Renewable Energy Facility (EREF)

The ECOWAS Renewable Energy Facility (EREF), launched by ECREEE in 2011, provides grant financing for small to medium-sized renewable energy and energy efficiency projects. EREF has funded over 40 projects across 12 member states, primarily in rural areas where energy poverty is most acute.

Projects under EREF include:

- Solar PV systems for schools and health centers in Mali and Niger.
- Mini-hydropower projects in Guinea and Sierra Leone.
- Biomass-based electrification schemes in Ghana and Côte d'Ivoire (ECREEE, 2016).

EREF has been instrumental in piloting innovative business models such as community energy cooperatives and public-private partnerships for mini-grid development. The facility is also linked to training and capacity-building activities, ensuring that funded projects contribute to long-term institutional development.

The West Africa Clean Energy Corridor (WACEC)

The West Africa Clean Energy Corridor (WACEC), supported by IRENA and ECOWAS, seeks to enhance the development and integration of utility-scale renewable energy projects within the regional power grid. The corridor initiative focuses on developing cross-border transmission infrastructure and increasing regional electricity trade through clean energy.

Key components of WACEC include:

- Mapping renewable energy zones with high solar and wind potential.
- Coordinating investment in large-scale projects such as solar parks and wind farms.
- Strengthening the role of the West African Power Pool (WAPP) to facilitate electricity trade (IRENA, 2020).

The corridor is particularly important for landlocked countries such as Burkina Faso and Mali, which can benefit from energy imports generated in coastal regions with high renewable potential.

National-Level Project Implementation

While regional projects provide a unifying framework, project implementation is largely undertaken at the national level. Many ECOWAS member states have made significant progress in deploying renewable energy technologies through public investment, donor support, and private sector participation.

Ghana: Renewable Energy Master Plan

Ghana has emerged as one of the regional leaders in renewable energy development. The Ghana Renewable Energy Master Plan, launched in 2019, outlines a roadmap for scaling up renewable energy to achieve 10% of the national electricity mix from renewables by 2030 (excluding large hydropower).

Key projects include:

- The Bui Solar Project, a 250 MW solar PV plant under development.
- Several mini-grid installations for island and lakeside communities.
- Off-grid solar home system programs supported by the Ghana Energy Development and Access Project (GEDAP).

Ghana has also implemented regulatory frameworks such as feed-in tariffs, net metering, and renewable energy purchase obligations to stimulate private sector investment (IRENA, 2020c).

Senegal: Scaling Solar and Rural Electrification

Senegal has rapidly expanded its solar power capacity through the Scaling Solar Program, implemented in partnership with the International Finance Corporation (IFC). Two major solar PV plants—Kahone (35 MW) and Kael (25 MW)—have been commissioned, significantly reducing the cost of electricity generation.

The Programme d'Électrification Rurale (PERACOD) has also extended electrification through mini-grids powered by solar-diesel hybrid systems. The Senegalese Agency for Rural Electrification (ASER) plays a key role in coordinating decentralized energy access projects.

Senegal's policy consistency, political commitment, and innovative public-private partnership models have been widely cited as best practices in the region (Njie et al., 2021a).

Cape Verde: Island Electrification through Renewables

Cape Verde's ambitious goal of reaching 100% renewable energy penetration by 2030 has led to the implementation of numerous projects across its islands. With support from UNDP, the government has deployed wind farms, solar PV systems, and storage solutions.

Projects include:

- Cabeólica Wind Farms, providing over 25% of the national electricity supply.
- Solar-powered desalination plants for water access.

- Distributed solar systems for schools and health centers (UNDP, 2018).

As an island state with limited natural resources, Cape Verde demonstrates how strategic planning and international partnerships can drive renewable energy innovation.

Clean Cooking and Energy Efficiency Projects

Beyond electricity, ECOWAS countries face significant challenges in clean cooking, with over 80% of the population relying on biomass (wood and charcoal) for cooking. The health and environmental impacts are severe, especially for women and children.

Projects in this domain include:

- The ECOWAS Improved Cook stove Program, promoting clean biomass stoves and LPG distribution.
- Country-specific initiatives like Nigeria's National Clean Cooking Scheme (NCCS) and Ghana's Sustainable Energy for Households Program.
- Public awareness campaigns, subsidies, and local manufacturing initiatives to scale up adoption (SEforALL, 2020).

Energy efficiency projects are also being implemented, particularly in lighting, appliance standards, and industrial processes. The ECOWAS Efficient Lighting Initiative led to a region-wide phase-out of incandescent bulbs and adoption of CFL and LED technologies (ECREEE, 2016).

Financing and Investment Mechanisms

A key factor in project implementation is access to finance. ECOWAS projects are funded through a mix of public resources, donor grants, concessional loans, and private sector investments.

Key financing instruments include:

- The ECOWAS Renewable Energy Investment Initiative (EREI), which connects investors with project developers.
- Results-Based Financing (RBF) schemes under ROGEP and GEDAP.
- Green bonds and climate finance mobilized through the Green Climate Fund (GCF), the African Development Bank (AfDB), and bilateral partners.

Despite progress, investment gaps remain. According to IRENA (2020c), the region requires over \$30 billion in cumulative investments by 2030 to meet renewable energy targets. De-risking tools, such as guarantees and insurance, are essential to attract private capital, especially in fragile states.

Achievements, Success Stories and Key Challenges

The ECOWAS region has made commendable strides in the development and deployment of renewable energy technologies over the past decade. Despite a range of economic, political, and infrastructural challenges, several notable achievements underscore the region's progress towards energy sustainability. These successes are evident in the increasing deployment of renewable energy systems, the establishment of supportive regulatory frameworks, the empowerment of regional institutions, and the improvement of energy access rates in underserved areas. This section highlights key accomplishments and success stories that serve as models for further renewable energy development in the region. It also discusses notable challenges to the region's energy sustainability.

Institutional Milestones and Policy Achievements

One of the most significant achievements has been the institutionalization of renewable energy governance in West Africa. The establishment of the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in 2010 marked a pivotal turning point for the region. ECREEE has played a central role in harmonizing energy policies, coordinating cross-border initiatives, and building technical capacity across member states (ECREEE, 2020).

The adoption of the ECOWAS Renewable Energy Policy (ERP) and the ECOWAS Energy Efficiency Policy (EEEP) in 2013 laid the foundation for long-term energy transformation. These policies set ambitious but achievable targets:

- 48% renewable energy share in electricity generation capacity by 2030.
- Universal access to clean cooking energy.
- Doubling the rate of improvement in energy efficiency (ECREEE, 2013).

As of 2023, most member states have adopted national renewable energy action plans (NREAPs) and energy efficiency action plans (NEEAPs) aligned with regional objectives. Countries like Ghana, Senegal, Cape Verde, and Nigeria have integrated these frameworks into their national energy strategies, resulting in improved coordination and investment attraction (IRENA, 2022).

Energy Access Expansion through Decentralized Solutions

Expanding electricity access remains a core development challenge in ECOWAS, especially in rural and peri-urban areas. Through decentralized renewable energy technologies, member states have recorded major breakthroughs in improving energy access.

4.2.1 Nigeria's Solar Home System Initiative

Nigeria, with the largest population in Africa, faces substantial energy access challenges. Yet, it has also emerged as a leader in deploying solar home systems (SHS) and mini-grids. Under the Solar Power Naija program, launched in 2020, over 1 million solar connections have been made, benefiting rural households and small businesses (RMI, 2021).

The program, funded through the Central Bank of Nigeria and supported by the Rural Electrification Agency (REA), aims to provide solar power to 25 million people by 2030. It leverages a results-based financing model to encourage private sector participation, thereby creating over 20,000 green jobs (World Bank, 2022). Companies like Lumos and Green Village Electricity (GVE) have pioneered innovative "pay-as-you-go" solutions that make solar energy affordable for low-income users.

Ghana's Island and Lakeside Electrification

In Ghana, the implementation of mini-grid projects on remote islands in the Volta Lake region stands out as a notable success. With support from the Ghana Energy Development and Access Project (GEDAP) and international donors, solar-hybrid mini-grids were constructed to electrify communities previously reliant on diesel generators or kerosene. Communities such as Pediatorkope and Aglakope now enjoy reliable electricity, which has transformed livelihoods, facilitated the establishment of health clinics, and improved education through lighting and ICT access (ESMAP, 2020). Ghana's model combines strong government leadership, donor coordination, and community engagement.

Renewable Energy Deployment: Grid and Off-Grid Successes

In recent years, several ECOWAS countries have achieved significant renewable energy penetration, particularly in solar and wind energy. These successes which are depicted in table 4 are characterized by the commissioning of large-scale projects and the diversification of energy sources.

Table 4. Growth of off-Grid Renewable Energy Systems in ECOWAS

Country	Installed Capacity (MW)	Households Reached	Main Off-Grid Technologies	Key Projects	Year Range
Nigeria	75	500,000+	Solar PV, Mini-grids, Solar Home Systems	Nigeria Electrification Project (NEP)	2015–2024
Ghana	35	200,000+	Solar PV, Biomass, Mini-grids	Renewable Energy Master Plan Projects	2015–2024
Senegal	50	300,000+	Solar PV, Wind, Hybrid Systems	Scaling Solar, ASER rural electrification	2016–2024
Burkina Faso	20	150,000+	Solar PV, Solar Water Pumps	Yeleen Rural Electrification Program	2017–2024
Mali	18	100,000+	Solar PV, Diesel-Solar Hybrid Mini-grids	Rural Electrification Agency Initiatives	2016–2024
Niger	10	75,000+	Solar PV	World Bank Solar Access Projects	2018–2024
Sierra Leone	12	90,000+	Solar PV, Mini-grids	Renewable Energy Mini-Grid Program	2017–2024
Togo	15	100,000+	Solar PV, Solar Home Systems	CIZO Project (Lighting Program)	2017–2024
Benin	10	60,000+	Solar PV, Mini-grids	MCA-Benin II Off-Grid Projects	2018–2024
Guinea	5	40,000+	Solar PV	Rural Electrification Support	2018–2024

Sources: (1) ECREEE (2024), www.ecreee.org (2) ECOWREX (2024), <https://ecowrex.org>

Senegal's Scaling Solar Projects

Senegal has been at the forefront of solar energy deployment in the region. Through the Scaling Solar program, implemented in collaboration with the International Finance Corporation (IFC), the government successfully attracted private investment for two solar PV plants—Kael (25 MW) and Kahone (35 MW).

These projects were developed under competitive bidding, resulting in some of the lowest solar tariffs in sub-Saharan Africa at €0.04 per kWh (IFC, 2020). They now contribute a significant share to the national electricity grid and reduce the country's reliance on expensive fossil fuel imports.

Senegal has also integrated solar into its rural electrification strategy. The Senegalese Agency for Rural Electrification (ASER) has promoted solar mini-grids and hybrid systems

that have electrified hundreds of villages. This success is attributed to robust policy frameworks, donor alignment, and community ownership models (Njie et al., 2021b).

Cape Verde's Renewable Energy Mix

As an island nation with no domestic fossil fuel resources, Cape Verde has embraced renewables as a cornerstone of its energy strategy. By 2023, the country had achieved over 25% renewable energy penetration, with a mix of wind, solar, and small hydropower (UNDP, 2022).

Projects such as the Cabeólica Wind Farms, which contribute 20% of the country's electricity supply, and the deployment of solar-powered desalination units for water production, exemplify how renewable energy can address multiple development needs. Cape Verde's ambition to reach 100% renewable electricity by 2030 is backed by strong international partnerships and a dedicated regulatory agency, ARE (Agência de Regulação Económica).

Ghana – Scaling Solar PV

Ghana has initiated various large-scale PV projects, including:

- **Nzema Solar Plant** (155 MW, under development): Expected to be one of the largest in West Africa.
- **Kpone Solar Park** and multiple rooftop solar schemes.

The government's Net Metering Code and Renewable Energy Master Plan have attracted private investors and IPPs into the solar space (ECREEE, 2024)

Capacity Building and Knowledge Transfer

The ECOWAS region has recognized that infrastructure alone cannot sustain renewable energy growth. Thus, capacity building and knowledge transfer have become integral components of project design and policy implementation.

ECREEE Training Programs

ECREEE has conducted over 200 training programs on renewable energy planning, project development, solar PV installation, and energy auditing. These have targeted national policymakers, technicians, utility managers, and entrepreneurs. By 2022, over 3,000 professionals had received specialized training, enhancing local capacity for project implementation and maintenance (ECREEE, 2022).

Partnerships with technical institutions such as the International Institute for Water and Environmental Engineering (2iE) in Burkina Faso and the Renewable Energy and Energy Efficiency Partnership (REEEP) have expanded access to practical and online courses across the region.

Gender Inclusion in Energy Access

A notable achievement has been the increased emphasis on gender inclusion in energy programming. ECREEE launched the ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN) in 2015 to ensure that women are active participants and beneficiaries of energy transition.

Projects under ECOW-GEN include:

- Training women in solar installation and maintenance.
- Supporting women-led energy businesses.
- Designing cook stove projects that reduce indoor air pollution (ECOW-GEN, 2021).

These initiatives have helped bridge the gender gap in energy access and employment, particularly in rural areas.

Regional Integration and Cross-Border Cooperation

One of the cornerstones of ECOWAS's energy success has been its commitment to the development of the West African Power Pool (WAPP) has facilitated cross-border electricity trade and enabled countries with excess renewable capacity to supply neighboring nations.

For example:

- Côte d'Ivoire has exported electricity generated from hydro and solar sources to Burkina Faso, Ghana, and Mali.
- The OMVG (Organisation pour la Mise en Valeur du fleuve Gambie) project, which includes The Gambia, Guinea, Guinea-Bissau, and Senegal, is constructing a 1,677 km transmission line to integrate hydropower and solar energy into the regional grid (AfDB, 2022).

These developments highlight how collaboration reduces redundancy, enhances energy security, and promotes cost-effective renewable energy deployment.

Key Challenges

Despite the progress recorded by ECOWAS in renewable energy development, the region continues to grapple with several challenges that hinder the achievement of its energy transformation goals. These issues range from financing constraints and infrastructural deficits to weak institutional capacities and policy inconsistencies.

a. Financing and Investment Barriers: One of the most pressing challenges is the lack of adequate financing mechanisms for renewable energy projects. Many ECOWAS countries struggle to attract long-term investment due to perceived political risks, currency volatility, and underdeveloped capital markets (IRENA & AfDB, 2022). Although donor-funded projects and development finance institutions have played critical roles, private sector participation remains limited due to insufficient incentives and unclear regulatory frameworks.

b. Infrastructural and Technical Limitations: Many areas in the region face poor grid infrastructure, limited transmission capacity, and frequent power outages. These issues hinder the integration of renewable energy into national grids and make it difficult for developers to reach remote communities (World Bank 2022, Ayodele et al., 2022).). Additionally, there is a lack of local manufacturing capacity for renewable technologies, which increases dependency on imports and raises project costs.

c. Institutional and Human Capacity Gaps: While institutions like ECREEE have made progress, many national energy agencies lack the technical and managerial expertise to plan, implement, and monitor complex renewable energy projects. Furthermore, brain drain and limited technical training opportunities impede the development of a skilled workforce (ECREEE, 2020).

d. Policy and Regulatory Inconsistencies: The renewable energy policy environment across ECOWAS countries is often fragmented or inconsistently enforced. Weak enforcement of power purchase agreements (PPAs), delays in licensing, and overlapping jurisdictional mandates discourage investment and lead to project delays (IRENA, 2020a).

e. Political Instability and Security Concerns: Political instability and regional conflicts are significant deterrents to renewable energy development in certain ECOWAS countries. For example, former ECOWAS member countries such as Mali, Burkina Faso, and Niger have faced insurgencies and political upheavals that disrupted energy infrastructure, delayed project timelines, and scared off investors (World Bank, 2021). In such environments, long-term planning and investment become highly risky, and donor agencies may hesitate to allocate funds.

f. Corruption and lack of transparency: Corruption and lack of transparency in government contracting processes also undermine confidence in renewable energy programs. Issues such as inflated project costs, favoritism in awarding contracts, and misuse of public funds have been reported, leading to inefficiencies and public distrust in renewable energy initiatives (ECREEE, 2023).

Conclusion and Policy Recommendations

Conclusion

The ECOWAS region has made commendable progress in the adoption and implementation of renewable energy policies and development projects over the past decade. Through the establishment of robust institutional frameworks such as ECREEE, the formulation of comprehensive policy instruments like EREP and EEEP, and the execution of large- and small-scale renewable energy projects, member states have demonstrated a clear commitment to transitioning towards sustainable and inclusive energy systems.

Significant achievements—ranging from the electrification of remote communities via mini-grids in Ghana and Nigeria to the successful deployment of grid-scale solar farms in Senegal underscore the viability and potential of renewable energy to address the region's

longstanding energy access deficits. Moreover, the emphasis on regional integration through the West African Power Pool and knowledge sharing platforms like ECOWREX reflects a growing maturity in ECOWAS's approach to energy governance.

However, this progress has not been without challenges. Persistent financing constraints, infrastructural inadequacies, institutional capacity gaps, and policy implementation inconsistencies, among others, continue to hinder the full realization of renewable energy goals. These challenges, if not addressed, may slow the momentum and delay the achievement of the region's 2030 renewable energy targets.

Looking ahead, the future of renewable energy in ECOWAS is promising, but contingent on coordinated policy action, increased investment, and sustained research. Bridging critical research gaps—particularly in data availability, socio-economic impact assessment, and sustainable financing will be key to designing more effective interventions and enhancing the region's energy resilience.

In conclusion, the ECOWAS renewable energy journey offers valuable lessons not only for West Africa but for other regions pursuing energy transitions under resource-constrained conditions. Continued commitment, innovation, and collaboration at national, regional, and international levels will be essential to drive forward a just, inclusive, and climate-resilient energy future

Policy Recommendations

- **Strengthen Regional and National Investment Frameworks:** ECOWAS should harmonize investment regulations across member states and promote risk mitigation instruments such as guarantees, political risk insurance, and blended finance. Establishing green investment platforms, like regional green banks or revolving funds, can help bridge the financing gap and catalyze private sector engagement (AfDB, 2022).
- **Improve Grid Infrastructure and Encourage Decentralized Solutions:** Governments should prioritize investment in transmission and distribution infrastructure to enable the efficient integration of renewable energy. Simultaneously, support for decentralized energy solutions (e.g., mini-grids and solar home systems) should be scaled up through regulatory reforms and results-based financing (ESMAP, 2021).
- **Enhance Institutional and Technical Capacity:** Expanding capacity-building initiatives and supporting academic institutions that offer energy-related programs is vital. ECREEE and other regional partners should continue facilitating knowledge-sharing platforms and technical exchange programs to build a robust human resource base.
- **Streamline Policy and Regulatory Frameworks:** ECOWAS should support member states in simplifying licensing procedures, standardizing PPAs, and establishing

independent energy regulators. Clear, transparent, and enforceable policy frameworks are critical to attracting and retaining investors.

- **Foster Innovation and Local Manufacturing:** Encouraging technology transfer, local production of solar and wind components, and innovation hubs can stimulate job creation and reduce reliance on imports. Governments should offer tax incentives and research grants to promote domestic clean tech industries.
- **Improving Political Stability and Security Concerns:** Political instability and regional conflicts should be discouraged in order to attract considerable renewable energy developments in ECOWAS countries. Such environments will make long-term planning and investment become less risky and donor agencies will not hesitate to allocate funds.
- **Elimination of Corruption and lack of transparency:** Government contracting procedures that are free of corruption and malpractices will boost public trust in renewable energy projects and increase program efficiency.

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