

Design of Policy Framework for Coastal Wind Energy Deployment in West Africa: A Comparative Analysis of Nigeria, Benin, Mauritania, Togo, Guinea, Côte D'ivoire, and Ghana

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Abstract

The successful deployment of coastal wind energy in West Africa depends on national policy frameworks. This study compares energy policies, renewable targets, regulatory frameworks, institutions, and deployment strategies in seven coastal states: Nigeria, Benin, Mauritania, Togo, Guinea, Côte d'Ivoire, and Ghana. Using a mixed-methods design, it examines key policy instruments (feed-in tariffs, tax incentives, net metering, auctions, and investment funds) and assesses policy maturity and implementation. The findings show wide disparities: Mauritania has the most advanced wind deployment and enabling policies; Ghana has a cohesive framework but limited implementation; Nigeria's fragmented regulation constrains progress despite ambitious targets; and Benin, Togo, Guinea, and Côte d'Ivoire remain at an early stage with little operational capacity. Barriers include institutional fragmentation, weak enforcement, fossil fuel subsidies, inadequate grids, and limited technical capacity. Regional ECOWAS mechanisms offer opportunities for policy harmonisation but lack binding enforcement. The study recommends a regional wind energy task force, standardised PPAs, harmonised regulatory standards, and targeted capacity building to accelerate coastal wind deployment through regional integration.

1. Introduction

The global energy transition is accelerating, driven by climate change concerns and falling prices of clean energy technologies (Hassan et al., 2024; Fan et al., 2024). Wind energy is the most important source of energy in this transition, with an estimated capacity of 1,133 GW by 2024 (IRENA, 2025). However, wind energy in Africa, particularly West Africa, is relatively low compared to its technical potential.

With its long Atlantic coast, West Africa has a lot of wind resources (Adesanya et al., 2021; Almar et al., 2023). The region's coastal areas experience consistent wind speeds driven by the Atlantic trade winds, with mean wind speeds at 100 m height ranging from 4.90 m/s (Guinea) to 9.54 m/s (Mauritania) (Global Wind Atlas, 2025). Despite this potential, wind energy accounts for less than 1% of the region's electricity generation, with only Mauritania (102.375 MW) and Nigeria (10 MW) having utility-scale wind farms (IRENA, 2024).

There is a large literature on the technical potential of wind energy in West Africa (Lima et al., 2021; Merem et al., 2022; Adaramola, 2014), the economic viability (Ibeh et al., 2025), and the respective country case studies (Agyekum, 2020; El Moustapha et al., 2024; Tchodou et al., 2018). Yet this is not the case for comparative analysis of policy frameworks by several West African countries. Specifically, prior research has not systematically examined how differences in policy design, regulatory frameworks, and institutional capacity affect wind energy deployment outcomes in the region.

Policy frameworks are critical to renewable energy deployment (Addison & Roe, 2024; Shi, 2024). Well-designed policies provide the signals and incentives to attract investment, reduce project risks, and guide development (IRENA, 2019). The European wind industry, for example, has seen remarkable growth in the past decade as a result of good policies (e.g., feed-in tariffs (FITs), etc.) in the early stages of the sector (Döme, 2024). Recently, competitive auctions have become the standard mechanism to purchase renewable energy electricity in many African countries such as South Africa, Morocco and Senegal (IRENA, 2019b).

This study addresses the gap in policy analysis by providing a systematic comparative assessment of wind energy policy frameworks across seven West African nations: Nigeria, Benin, Mauritania, Togo, Guinea, Côte d'Ivoire, and Ghana. The study examines existing energy policies, regulatory frameworks, institutional structures, and deployment strategies, identifies barriers to policy harmonisation, and proposes a harmonised framework to facilitate the regional integration of coastal wind energy.

This study aims to critically investigate the existing energy policies and regulatory frameworks at both national and regional levels within the case study countries, identify the barriers and opportunities for policy harmonisation across the seven nations, compare wind energy deployment strategies and incentives in each country, and develop a harmonised policy framework for coastal wind energy deployment in West Africa, drawing on successful policy models from other regions.

2. Materials and Methods

2.1 Research Design and Approach

This study employs a mixed-methods research design, combining quantitative analysis of policy indicators with qualitative comparative policy analysis. The geographical scope includes the coastal zones of Nigeria, Benin, Mauritania, Togo, Guinea, Côte d'Ivoire, and Ghana. The study adopts a comparative approach to examine wind energy policy frameworks, considering their implications for regional integration and the enhancement of renewable energy extraction.

2.2 Data Collection Methods

Data collection employed multiple methods tailored to the research objectives. Data on existing energy policies, regulatory frameworks, and institutional structures were gathered from government publications (national energy policies, renewable energy master plans, legislation), legislative documents (parliamentary acts, regulations), and reports from international organisations (World Bank, IRENA, AfDB, ECOWAS). Policy databases (Climate Policy Database, REN21 Policy Database) were also consulted. Information on wind energy projects (installed capacity, operational status, commissioning dates, developers) was collected from industry reports (GWEC, BloombergNEF), project databases (Global Energy Monitor, Power Technology), and national utility reports. Information on institutional structures (ministries, regulatory agencies, and dedicated renewable energy agencies) was obtained from government websites, institutional reports, and international organisation assessments such as IRENA Renewable Readiness Assessments.

2.3 Data Analysis Techniques

The study utilised a range of analytical techniques. A systematic comparative policy analysis approach was adopted to examine policy instruments (feed-in tariffs, tax incentives, auctions, net metering, renewable energy funds), regulatory mechanisms (grid codes, permitting processes, interconnection standards), and institutional arrangements (dedicated renewable energy agencies, regulatory bodies) across the seven countries. Barriers to wind energy deployment and policy harmonisation were categorised using an adapted classification framework drawing on Naicker and Thopil (2019) and Diogenes et al. (2020), encompassing institutional/regulatory, economic/financial, market, social, and technical barriers. Successful policy models from other regions (Europe, North America, South Africa) were analysed to identify transferable policy instruments and design elements, and to adapt them to the specific West African context. Findings from the comparative analysis and barrier assessment were synthesised to develop a harmonised policy framework, considering the potential for regional integration and the specific socio-economic and regulatory landscapes of West Africa.

2.4 Analytical Framework

The analysis was guided by a policy framework assessment matrix examining seven dimensions: policy targets (existence and ambition of renewable energy and wind-specific targets), regulatory framework (presence and comprehensiveness of renewable energy legislation, grid codes, and interconnection standards), policy instruments (deployment of feed-in tariffs, auctions, tax incentives, net metering, and renewable energy funds), institutional structure (existence of dedicated renewable energy agencies, regulatory bodies, and coordination mechanisms), implementation capacity (technical expertise, administrative capacity, and track record of project implementation), regional integration (participation in regional initiatives such as ECOWAS and WAPP and cross-border cooperation mechanisms), and investment climate (perceived investor confidence, risk profile, and access to financing).

2.5 Country Selection and Scope

Countries were selected based on two criteria: (1) Geographic location along the Atlantic coast of West Africa, and (2) Availability of consistent wind resource and policy data. The coastal focus was operationalised as onshore areas within 50 km of the coastline, acknowledging that this is where the most promising wind resources are concentrated (Global Wind Atlas, 2025).

3. Results

3.1 Overview of National Energy Policies and Renewable Energy Targets

Table 1 presents a summary of national energy policies and renewable energy targets across the seven countries, revealing significant heterogeneity in ambition and policy maturity. Nigeria has established a Renewable Energy Master Plan (REMP) and an Energy Transition Plan aiming for Net Zero by 2060 (Federal Government of Nigeria, 2021). The country's NDC sets targets of 30% on-grid electricity from renewables and 13 GW of off-grid renewable energy by 2030, with a specific wind target of 0.8 GW of grid-connected capacity (Nigeria Energy Roadmap Report, 2023). However, policy implementation has been inconsistent, with the Katsina Wind Farm (10 MW) experiencing operational challenges and the Gurara II Wind Farm (50 MW) remaining under development. Benin adopted a National Policy for Renewable Energy Development (PONADER) in 2020 to valorise its renewable potential (FAO, n.d.). The country's National Electrification Strategy aims for universal access to energy by 2030, with a significant contribution from off-grid solutions (GOGLA, 2024). Benin has been working on strengthening its power sector regulation with support from the Millennium Challenge Corporation (MCC, 2022). However, no utility-scale wind projects have been operationalised, with the Port of Cotonou Wind Farm remaining in the pre-feasibility phase.

Mauritania stands out for its ambitious renewable energy targets, aiming for 35% of energy to be renewable by 2030 and 50% by 2050 (IRENA, 2015). The country has introduced Law No. 2024-037 on green hydrogen projects, which outlines institutional and regulatory frameworks, including competitive bidding processes (Clifford Chance, 2025). Mauritania has the most advanced wind energy deployment in the region, with 102.375 MW operational (Boulenouar Wind Power Station) and 30 MW operational (Nouakchott Wind Farm). Togo has set a target to utilise wind resources for electricity production by 2025, aiming to meet 5–7% of its electricity needs from wind energy

(Tchodou et al., 2018). The country aims to achieve 20% renewable energy in its mix by 2030 and 100% electrification by the same year (GET.invest, 2024). However, concrete implementation of wind projects has been limited, with the Lomé wind farm (24 MW) reportedly cancelled (Global Energy Monitor, n.d.).

Côte d'Ivoire aims to achieve 42–45% renewable energy in its mix by 2030 (Kouadio et al., 2024; AfDB, n.d.). The government has planned a wind energy pilot project with a capacity of at least 100 MW, targeting potential locations in the mountainous west, plains of the east, and coastline in the south (Africa Energy Portal, 2024). However, no operational utility-scale wind projects exist, and a report states that the country is entirely unsuitable for wind energy due to insufficient wind speeds in certain regions. Ghana has established a Renewable Energy Master Plan to increase the proportion of renewable energy in its national energy generation mix to 10% by 2030 (IRENA, 2015; Energy Commission of Ghana, 2019). The Renewable Energy Act of 2011, amended in 2020, provides the legal framework for promoting renewable energy development (IRENA, 2015; Climate Policy Lab, 2025). Ghana has a substantial pipeline of planned wind energy projects, totalling approximately 1,365 MW (ESI-Africa.com, 2023), with the Ayitepa Wind Farm (225 MW) in the advanced stages of development. Guinea has set a target to increase the share of renewables in its electricity production to 80% by 2030, with a focus on hydropower and solar (Trend News Agency, 2024). The NDC aims to reduce GHG emissions by 20% (unconditional) to 49% (conditional) by 2030. However, specific wind energy targets and policies are limited, and no utility-scale wind projects have been operationalised, with the Boffa Wind Farm (120 MW) remaining at the announcement stage.

Table 1
Renewable Energy Targets in West African Countries (Case Study Countries)

Country	Wind Energy Target	Overall Renewable Energy Target	Target Year	Source
Nigeria	0.8 GW grid-connected	30% on-grid electricity from renewables; 13 GW off-grid	2030	Nigeria Energy Roadmap Report, 2023; NDC (2021)
Benin	Accelerate generation	Universal access by 2030	2030	CIF, 2024; GOGLA, 2024
Mauritania	Increase share (102 MW by 2030)	35% by 2030, 50% by 2050	2030, 2050	IRENA, 2015; Yahya et al., 2024
Togo	5–7% of electricity	20%	2025, 2030	Tchodou et al., 2018; GET.invest, 2025
Côte d'Ivoire	Increase share	42–45%	2030	Kouadio et al., 2024; AfDB, 2024
Ghana	Increase share	10% (non-hydro grid-connected; 1,365 MW planned)	2030	IRENA, 2015; Energy Commission of Ghana, 2019; Climate Policy Lab, 2025
Guinea	2% by 2025	80% renewable in electricity generation	2030	NDC (2021)

Source: Author's compilation based on national policy documents and NDCs

3.2 Comparative Analysis of Policy Instruments

Table 2 presents a comparative analysis of policy instruments deployed across the seven countries, revealing significant variation in policy approaches. Feed-in tariffs are operational in Nigeria (12.5 US cents/kWh) and Ghana (16 US cents/kWh), with Benin and Mauritania also having FiT frameworks. However, the effectiveness of FiTs has been limited. Ghana's initial FiT strategy (2011) struggled to attract investors, partly due to its 10-year contract limit and capacity restrictions (ICLG.com, 2025). Although the government extended contracts to 20 years and eased capacity caps in 2016, unsolicited and negotiated power purchase agreements became the preferred method. This led to a high-cost energy system, prompting Ghana to impose a moratorium on new PPAs as of 2020.

Tax incentives are the most widely deployed policy instrument, with all countries except Mauritania offering them. These include import duty exemptions on renewable energy equipment, income tax holidays (typically 5–10 years), and tax exemptions on income from carbon credit sales (Ghana), pioneer status incentives (3–5 years tax holidays for manufacturers of solar equipment) and VAT and import duty exemptions (Nigeria), and import duty waivers for solar products (Togo) (ICLG.com, 2025; AO2LAW, 2025; GOGLA, 2022). Competitive auctions are operational in Ghana and Mauritania, and are being considered in other countries. Auctions are increasingly favoured over FiTs due to their effectiveness in competitively determining renewable energy prices and driving down costs (IRENA, 2019b). South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) exemplifies this trend, having conducted four auction rounds since 2011, attracting over US\$19 billion in private investment and leading to substantial electricity price reductions (46% for wind and 71% for solar). Net metering is operational only in Ghana among the studied countries. Net metering allows consumers who own or

lease renewable energy systems to receive credit for excess energy they produce and feed back into the grid, making residential wind systems economically viable (Great Lakes Commission, 2011). Nigeria and Ghana have established renewable energy investment funds. Ghana's Renewable Energy Fund provides financial resources for promotion and development (ICLG.com, 2025), and a bill is under review to establish a Renewable Energy Agency to oversee the Renewable Energy Investment Fund (RenewAfrica.Biz, 2025).

Table 2
Promotion Policies for Renewable Energy in Selected West African Countries

Country	All RES Targets	Wind Energy Target (MW)	Current Wind Energy Generation (MW)	FiT/Premium	FiT (US Cents/kWh)	Tax Incentives	Net Metering	Auctions	RE Investment Funds
Benin	X			X		X			
Côte d'Ivoire	X					X			
Ghana	X			X	16	X	X	X	
Guinea	X	2% by 2025				X			
Mauritania	X	102 by 2030	34.4	X				X	
Nigeria	X	0.8 GW grid-connected by 2030	2 MW	X	12.5	X			
Togo	X	5–7% of electricity by 2030				X			

Source: Adapted from Alemzero et al. (2021) and IRENA (2022)

3.3 Regulatory Frameworks and Institutional Structures

Table 3 presents an overview of regulatory frameworks and institutional structures across the seven countries, revealing significant variation in institutional capacity. Nigeria has a relatively comprehensive regulatory framework, guided by the revised National Energy Policy (2022), with the Energy Commission of Nigeria playing a key role in developing renewable energy roadmaps and policies (Federal Republic of Nigeria, 2022). The Nigeria Energy Transition Office (ETO) was established in 2022 to support implementation of the country's Energy Transition Plan (Federal Government of Nigeria, 2021). However, challenges persist in policy implementation and coordination across multiple agencies. Benin's power sector regulation is being strengthened with support from the MCC (MCC, 2022). A national regulatory agency oversees off-grid electrification, and the government has established the Off-Grid Clean Energy Facility (OCEF) to promote access to renewable energy (MCC, 2022; GOGLA, 2024). However, institutional capacity remains limited, and the absence of a dedicated wind energy agency hinders development.

The Ministry of Petroleum, Energy, and Mines supports Mauritania's energy policy and development. International organisations such as IRENA and UNDP have played significant roles in assisting the country in developing national renewable energy strategies (IRENA, 2015). The recent green hydrogen law (2024-037) represents a significant step forward in regulatory development (Clifford Chance, 2025). Togo's General Directorate of Energy governs renewable energy activities. The Togolese Agency for Rural Electrification and Renewable Energy (AT2ER) was established in 2016 to provide electricity to rural communities (Togolese Republic, 2021; CIF, 2024). However, institutional capacity remains limited, and the regulatory framework for wind energy specifically is still developing.

Côte d'Ivoire's energy policy is set by the Ministry of Mines, Petroleum, and Energy (MMPE) (U.S. Department of Commerce, 2024; ERM, 2016). The Côte d'Ivoire Electricity Sector Regulation National Authority (ANARE-CI) acts as the regulatory agency for the electricity sector (U.S. Department of Commerce, 2024). CI-ENERGIES, a state-owned entity, is responsible for monitoring and managing the electricity system. However, no dedicated wind energy agency exists. Ghana has the most comprehensive regulatory framework among the countries studied, with the Renewable Energy Act of 2011 (amended in 2020) providing the legal basis for promoting renewable energy development (Climate Policy Lab, 2025). The Energy Commission plays a role in developing relevant codes and standards. The National Energy Transition Implementation Committee and a coordinating office will drive implementation of Ghana's Energy Transition Framework (Ministry of Energy Ghana, 2023). A bill is under review to establish a Renewable Energy Agency (RenewAfrica.Biz, 2025). Guinea has very limited information

available on regulatory frameworks and institutional structures for the energy sector, suggesting significant gaps in institutional capacity and policy development.

Table 3
Regulatory Frameworks and Institutional Structures in Selected West African Countries

Country	Regulatory Framework	Key Institutions	Institutional Capacity	Wind Energy Agency
Nigeria	National Energy Policy (2022); REMP	Energy Commission of Nigeria; Nigeria Energy Transition Office	Moderate	None (but ECN coordinates)
Benin	PONADER (2020). National Electrification Strategy	Benin Renewable Energy Agency; Off-Grid Clean Energy Facility (OCEF)	Low	None (but plans for Rural Electrification Agency)
Mauritania	Law No. 2024-037 (Green Hydrogen)	Ministry of Petroleum, Energy, and Mines	Moderate	None
Togo	General Electricity Code	General Directorate of Energy; Togolese Agency for Rural Electrification and Renewable Energy (AT2ER)	Low	AT2ER
Côte d'Ivoire	Law No. 2014 – 132 (Electricity Code)	Ministry of Mines, Petroleum, and Energy (MMPE); ANARE-CI (Regulator); CI-ENERGIES	Moderate	None
Ghana	Renewable Energy Act (2011, amended 2020); REMP	Energy Commission; Public Utilities Regulatory Commission (PURC)	Moderate	Proposed (under review)
Guinea	Limited information	Limited information	Very Low	None

Source: Author’s compilation based on national policy documents and institutional reports

3.4 Current Status of Wind Energy Deployment

Table 4 summarises the current status of wind energy projects across the seven countries, revealing significant variation in deployment outcomes. Mauritania has the most advanced wind energy deployment, with 34.4 MW operational and 102.375 MW under construction. The operational Nouakchott Wind Farm (30 MW, commissioned 2016) has demonstrated a strong operational record, with a total energy supply of 507.39 GWh to the power grid and a high average capacity factor of 42.55% between 2015 and 2019 (El Moustapha et al., 2024). The Boulenouar Wind Power Station (102.375 MW, commissioned 2022) represents the largest wind power plant in Mauritania. Ghana has a substantial pipeline of planned wind energy projects, totalling approximately 1,365 MW (ESI-Africa.com, 2023), with the Ayitepa Wind Farm (225 MW) in the advanced stages of development. The Ayitepa project, developed by Upwind Ayitepa Ltd. with Lekela Power as constructor and operator, has secured all necessary permits and is working towards financial close (NEK Umwelttechnik AG, 2016). Recent updates indicate that construction is expected to commence soon, with the first turbines potentially delivering energy to the grid in 2024/2025 (Upwind International, n.d.).

Nigeria has limited operational capacity (10 MW in Katsina), with the wind farm experiencing operational challenges and non-functional issues (The Nation Newspaper, 2024; Daily Trust, 2025). The Gurara II Wind Farm (50 MW) remains under development, while the Lagos Wind Project (50 MW) is listed as "Dormant" (Power Technology, 2024). Togo has limited operational capacity (6 MW, Plateaux), with 10 MW under construction (Maritime) and the Lomé wind farm (24 MW) cancelled (Global Energy Monitor, n.d.). Benin, Guinea, and Côte d'Ivoire have no operational wind energy projects, with projects remaining at the planning or announcement stage.

Table 4
Summary of Wind Energy Projects in West Africa

Country	Operational (MW)	Under Construction (MW)	Planned/Announced (MW)	Cancelled/Dormant (MW)	Total Pipeline (MW)
Nigeria	10 (Katsina)	50 (Gurara II)	~ 10 (other potential)	50 (Lagos - Dormant)	~ 120
Benin	0	0	18–30 (Port of Cotonou)	0	18–30
Mauritania	34.4 (Nouakchott: 30; Nouadhibou: 4.4)	102.375 (Boulenouar)	Unknown	0	~ 136.8
Togo	6 (Plateaux)	10 (Maritime)	Unknown (River Zio)	24 (Lomé - Cancelled)	~ 40
Guinea	0	0	120 (Boffa)	0	120
Côte d'Ivoire	0	0	100+ (Wind Energy Pilot)	0	100+
Ghana	0	225 (Ayitepa)	1,300+ (Anansi Energy), 150 (VRA Projects)	76.5 (VRA II - Dormant), Anloga (Cancelled)	~ 1,750+

Source: Author's compilation based on project databases and industry reports

3.5 Barriers to Wind Energy Deployment and Policy Harmonisation

Table 5 presents a categorisation of barriers to wind energy development and policy harmonisation across the seven countries, based on the adapted classification framework. Institutional and regulatory barriers include weak policy implementation, conflicting institutional mandates, insufficient R&D investment, and lack of dedicated wind energy agencies. Across much of Africa, while frameworks and policies for wind energy deployment exist on paper, their translation into concrete investments is often minimal. This disconnect is exacerbated by the general absence of dedicated industry associations and professional institutions to advocate for the promotion and expansion of wind energy (Naicker & Thopil, 2019). Conflicting institutional interests and ill-defined mandates for promoting renewable energy in many African countries further complicate the situation (Diogenes et al., 2020). Insufficient investment in research and development (R&D) poses a significant barrier, with R&D spending across most of the continent being less than 1% of GDP (UNECA, 2020).

Economic and financial barriers include high WACC (12–15%), limited access to concessional financing, high tax regimes, fossil fuel subsidies, and extended payback periods. Wind energy development in Africa faces significant economic and financial hurdles, primarily due to an uneven competitive landscape. High tax regimes across many African nations exacerbate this challenge by increasing operational expenses and the costs of essential wind energy equipment and services (IRENA, 2020). Continued government subsidies for fossil-fuel power plants in several countries create an unfair playing field, making wind energy comparatively more expensive and less attractive to the crucial private-sector investment needed to achieve economies of scale and drive down costs.

Market barriers include non-liberalised markets, policy prioritisation of conventional energy, externalities not internalised, and low awareness of renewables. Non-liberalised markets stifle competition, leading to higher operational costs and limiting access to diverse and reliable energy options (IEA, 2019). A significant challenge is the continued policy prioritisation of conventional energy sources, which often externalise their environmental pollution and health risks. This lack of internalisation means market prices for traditional fuels fail to reflect their actual societal cost, simultaneously obscuring the inherent environmental advantages of wind energy and other renewables.

Social barriers include NIMBYism, low public awareness, perception of wind as expensive, and lack of community engagement. Social acceptance is required for expanding renewable energy systems (RES), particularly wind power, across Africa. Wind farm developments often face strong public opposition, commonly known as the "Not in My Backyard (NIMBY)" phenomenon, driven by environmental and social concerns (Baah et al., 2021). A key challenge in Africa is the generally low public awareness of wind energy, with many citizens believing it is expensive and not a worthwhile government investment (Amadu et al., 2020).

Technical barriers include outdated grid infrastructure, a shortage of skilled personnel, a lack of local O&M capacity, curtailment risks, and land acquisition challenges. The integration of wind energy into Africa's power infrastructure faces significant technical hurdles, primarily due to the age of existing electricity grids. Many national grids across the continent are outdated, making it challenging to accommodate the intermittent nature of renewable sources like wind energy (IEA, 2019). A critical shortage of skilled human resources poses a significant barrier, as the continent lacks experienced personnel with the technical expertise required for the effective deployment and operation of wind energy projects (Diaf et al., 2011).

Table 5
Categorisation of Barriers to Wind Energy Development and Policy Harmonisation

Barrier Category	Specific Barriers	Countries Most Affected	Policy Implications
Institutional/Regulatory	Weak policy implementation; conflicting institutional mandates; insufficient R&D investment; lack of dedicated wind energy agencies	Nigeria, Benin, Guinea, Togo, Côte d'Ivoire	Need for institutional strengthening, clear mandates, and dedicated wind energy agencies.
Economic/Financial	High WACC (12–15%); limited access to concessional financing; high tax regimes; fossil fuel subsidies; extended payback periods	All countries (particularly Nigeria, Benin, Guinea)	Need for risk mitigation instruments; tax reform; subsidy reform; innovative financing mechanisms
Market	Non-liberalised markets; policy prioritisation of conventional energy; externalities not internalised; low awareness of renewables	All countries	Need for market liberalisation; internalisation of externalities; public awareness campaigns.
Social	NIMBYism; low public awareness; perception of wind as expensive; lack of community engagement	All countries (particularly Ghana, Nigeria)	Need for community engagement, benefit-sharing mechanisms, and public education.
Technical	Outdated grid infrastructure; shortage of skilled human resources; lack of local O&M capacity; curtailment risks; land acquisition challenges	All countries (particularly Nigeria, Ghana)	Need for grid modernisation, capacity building, and technical standards and certification.

Source: Adapted from Naicker and Thopil (2019) and Diogenes et al. (2020)

4. Discussion

4.1 Integration of Policy, Resource, and Economic Analysis

The integration of policy analysis with wind resource and economic analysis reveals a complex relationship between policy frameworks, resource potential, and deployment outcomes. Countries with favourable wind resources but weak policy frameworks (e.g., Nigeria, Ghana) have experienced limited deployment outcomes. Conversely, Mauritania, with strong wind resources and a relatively supportive policy environment, has achieved the most significant deployment in the region.

Nigeria presents a paradox: despite having significant wind resources (particularly in coastal areas) and a comprehensive policy framework with specific targets, actual deployment remains minimal (10 MW operational). This suggests that the gap between policy design and implementation is the primary barrier. The operational challenges experienced by the Katsina Wind Farm (10 MW), which has been non-functional for extended periods, further highlight the challenges of policy implementation and technical capacity (The Nation Newspaper, 2024; Daily Trust, 2025). Ghana has a strong policy framework (Renewable Energy Act, 2011) and a substantial pipeline of planned projects (~ 1,365 MW), but deployment has been slow. The Ayitepa Wind Farm (225 MW) has been in development since 2012 but has not yet reached commercial operation (NEK Umwelttechnik AG, 2016). This suggests that policy implementation, permitting processes, and financing arrangements represent significant barriers. Mauritania represents a relative success story, with 136.8 MW operational or under construction. The country's success can be attributed to a combination of factors: exceptional wind resources (9.54 m/s at 100m), strong government commitment to renewable energy, and effective international partnerships (El Moustapha et al., 2024; IRENA, 2015). The introduction of a green hydrogen law (2024-037) further demonstrates policy commitment (Clifford Chance, 2025). Benin, Guinea, and Côte d'Ivoire represent the early stages of policy development, with limited wind energy deployment and nascent policy frameworks. These countries face significant constraints on institutional capacity and limited investor confidence.

4.2 Policy Lessons from Successful Models

Drawing on successful policy models from other regions provides valuable insights for West African policymakers. The European Union's Renewable Energy Directive (2009/28/EC) established legally binding national renewable energy targets, creating a stable and predictable policy environment that drove investment in wind energy (European Parliament and Council, 2009; WindEurope, 2020). The directive's success demonstrates the value of legally binding targets, clear timelines, and regular progress reporting.

South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) demonstrates how competitive auctions can drive down costs and attract private investment. Between 2011 and 2021, the programme attracted over US\$19 billion in private investment and led to substantial electricity price reductions (46% for wind and 71% for solar) (Grobbelaar & Uriona, 2023). Key

success factors include standardised and transparent bidding processes, stable and bankable power purchase agreements (PPAs), clear local content requirements, community benefit-sharing mechanisms, and strong institutional capacity.

Germany's Renewable Energy Sources Act (EEG) demonstrated how well-designed feed-in tariffs can accelerate wind energy deployment during the early stages of market development (Döme, 2024). Key success factors include long-term contracts (20 years), guaranteed grid access, technology-specific tariffs, regular tariff adjustments based on learning rates, and cost-containment mechanisms. Morocco's integrated approach, combining ambitious renewable energy targets (52% by 2030), competitive auctions, and strong institutional support, has resulted in the successful deployment of large-scale wind projects (Tarfaya: 301 MW; Akhfenir: 200 MW). Key success factors include strong political commitment, clear institutional mandates, effective public-private partnerships, and regional integration through interconnection with Spain.

4.3 Proposed Harmonised Policy Framework for West Africa

Based on comparative analysis and lessons from successful policy models, this study proposes a harmonised policy framework for deploying coastal wind energy in West Africa. The framework is structured around six pillars.

Pillar 1 addresses legally binding targets and planning. This involves establishing legally binding national renewable energy targets with specific sub-targets for wind energy, embedded in national legislation and aligned with NDC commitments. A Regional West African Wind Energy Master Plan (WAWEMP) should be developed through the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), setting out a coordinated deployment pathway to 2030 and 2050. A regional monitoring and reporting mechanism should be established to track progress against targets, with annual progress reports and five-year reviews.

Pillar 2 addresses policy instruments and incentives. A phased approach to policy instruments should be implemented. Phase 1 (2025–2030) would involve feed-in tariffs for early-stage projects, with tariffs set at levels sufficient to attract investment and providing 15-20-year contracts with guaranteed grid access. Phase 2 (2028–2035) would involve a transition to competitive auctions, with standardised bidding documents, transparent evaluation criteria, and bankable power purchase agreements. Phase 3 (2030 onwards) would involve a full auction system with technology-neutral competitive bidding. Tax incentives should be harmonised across the region, including standardised import duty exemptions on wind energy equipment, standardised VAT reductions for wind energy projects, income tax holidays (5–10 years) for wind energy companies, and tax exemptions on income from carbon credit sales. A Regional Renewable Energy Investment Fund should be established to provide concessional financing for early-stage projects, guarantee facilities to reduce project risks, and technical assistance for project development.

Pillar 3 addresses the regulatory framework and grid integration. Harmonised regional grid codes and interconnection standards should be developed through the West African Power Pool (WAPP), including standardised technical requirements for wind farm connection, clear procedures for grid impact assessments, and requirements for reactive power capability and grid support. A regional power purchase agreement (PPA) framework should be established to facilitate cross-border electricity trading, including standardised PPA terms and conditions, clear dispute resolution mechanisms, and harmonised tariff structures. Permitting processes should be streamlined by establishing one-stop shops for wind energy project permitting, clear timelines for permit decisions, and standardised environmental impact assessment requirements.

Pillar 4 addresses institutional capacity and governance. A West African Wind Energy Task Force (WAWETF) should be established with representatives from national energy ministries, regulatory agencies, WAPP, ECREEE, private sector developers, and international partners. National institutional capacity should be strengthened by establishing dedicated renewable energy agencies in all countries, developing clear institutional mandates for promoting renewable energy, and building technical expertise through training and knowledge exchange. A regional wind energy training centre should be established to develop local technical expertise in operation and maintenance, project development and financing, policy design and implementation, and grid integration and system operation.

Pillar 5 addresses public engagement and social acceptance. Regional guidelines for community engagement and benefit-sharing should be developed, including minimum requirements for community consultation, benefit-sharing mechanisms (e.g., community ownership, revenue sharing), and grievance and dispute resolution mechanisms. Public awareness campaigns should be implemented to address misconceptions about wind energy, including educational programmes in schools, media campaigns highlighting wind energy benefits, and demonstration projects and site visits. A regional knowledge-sharing platform should be established to disseminate best practices, including case studies of successful projects, lessons learned from challenges and failures, and technical guides and manuals.

Pillar 6 addresses regional cooperation and integration. A regional wind energy pilot project should be developed to demonstrate the feasibility of cross-border wind energy integration, focusing on high-potential sites in Mauritania and coastal Nigeria, transmission interconnection through WAPP, and standardised regulatory and commercial arrangements. A regional green hydrogen initiative should be

established to leverage surplus wind capacity, including feasibility studies for green hydrogen production, demonstration projects, and the development of export infrastructure. Cooperation with international partners should be strengthened, including development finance institutions (AfDB, World Bank), technical assistance providers (IRENA, GIZ), and private sector investors.

4.4 Implementation Roadmap

Table 6 presents a phased implementation roadmap for the harmonised policy framework. Phase 1 (Policy Alignment, 2025–2027) involves harmonising national targets with the regional framework, establishing the West African Wind Energy Task Force, developing regional grid codes, and launching public awareness campaigns. Expected outcomes include aligned national targets, institutional coordination mechanisms, standardised grid codes, and enhanced public awareness.

Phase 2 (Institutional Strengthening, 2026–2028) involves establishing dedicated renewable energy agencies, developing the regional training centre, strengthening regulatory capacity, and implementing streamlined permitting. Expected outcomes include enhanced institutional capacity, a trained workforce, reduced permitting timelines, and clear institutional mandates.

Phase 3 (Pilot Projects, 2027–2030) involves implementing the regional wind pilot project, demonstrating cross-border trading, testing policy instruments, and building investor confidence. Expected outcomes include an operational cross-border project, demonstrated feasibility, bankable PPAs, and increased investor interest.

Phase 4 (Scaling Up, 2028–2035) involves scaling up auctions, expanding transmission infrastructure, increasing private investment, and accelerating deployment. Expected outcomes include significant capacity additions, competitive tariff reductions, private sector leadership, and regional energy integration.

Table 6
Implementation Roadmap for Harmonised Policy Framework

Phase	Timeline	Key Activities	Expected Outcomes
Phase 1: Policy Alignment	2025–2027	• Harmonise national targets with regional framework • Establish WAWETF • Develop regional grid codes • Launch public awareness campaigns	• Aligned national targets • Institutional coordination mechanisms • Standardised grid codes • Enhanced public awareness
Phase 2: Institutional Strengthening	2026–2028	• Establish dedicated renewable energy agencies • Develop regional training centre • Strengthen regulatory capacity • Implement streamlined permitting	• Enhanced institutional capacity • Trained workforce • Reduced permitting timelines • Clear institutional mandates
Phase 3: Pilot Projects	2027–2030	• Implement regional wind pilot project • Demonstrate cross-border trading • Test policy instruments • Build investor confidence	• Operational cross-border project • Demonstrated feasibility • Bankable PPAs • Increased investor interest
Phase 4: Scaling Up	2028–2035	• Scale up auctions • Expand transmission infrastructure • Increase private investment • Accelerate deployment	• Significant capacity additions • Competitive tariff reductions • Private sector leadership • Regional energy integration

4.5 Limitations of the Study

This study is subject to several limitations. First, the policy analysis relied on available documentation, and a more in-depth engagement with policymakers and stakeholders in each country could provide a richer understanding of policy implementation challenges and opportunities. Second, the study focuses on national-level policies and may not fully capture sub-national or local-level dynamics that affect wind energy deployment. Third, the study does not include a detailed political economy analysis, which could provide insights into the political feasibility of policy recommendations. Fourth, the proposed harmonised policy framework is based on best practice transfer from

other regions and may require adaptation to the specific West African context. Fifth, the study does not include a detailed cost-benefit analysis of the proposed policy instruments, which would be valuable for prioritising policy interventions.

5. Conclusion

This study has presented a comprehensive comparative analysis of policy frameworks for coastal wind energy deployment across seven West African nations. The findings reveal marked heterogeneity in policy maturity, institutional capacity, and deployment outcomes. Mauritania currently exhibits the most advanced wind energy policy framework and deployment record (136.8 MW operational or under construction), followed by Ghana, which has a strong policy framework but limited implementation, while Benin, Guinea, and Côte d'Ivoire remain at nascent stages with minimal wind energy infrastructure.

A pronounced policy implementation gap persists: although most countries have adopted policies and targets, translating these commitments into operational projects remains a major challenge. The divergence between policy design and implementation is the primary barrier to wind energy deployment in the region. Five categories of barriers impede policy harmonisation: institutional and regulatory (weak implementation, overlapping and conflicting mandates), economic and financial (high WACC, limited access to concessional finance), market-related (non-liberalised markets, fossil fuel subsidies), social (NIMBYism, low public awareness), and technical (outdated grids, skills shortages).

Successful policy models from other regions provide important lessons. The European Renewable Energy Directive, South Africa's REIPPPP, Germany's feed-in tariff system, and Morocco's integrated approach each offer relevant design elements for West African policymakers. Collectively, they underscore the value of a harmonised policy framework and a coordinated regional approach that combines legally binding targets, aligned policy instruments, regional grid codes, institutional strengthening, and robust regional cooperation mechanisms to unlock West Africa's coastal wind potential.

The proposed harmonised policy framework, structured around six pillars legally binding targets, policy instruments, regulatory framework, institutional capacity, public engagement, and regional cooperation offers a roadmap for accelerating wind energy deployment in West Africa. It emphasises a phased approach, recognising that policy instruments must evolve as markets mature and as deployment scales up.

Key recommendations include establishing a West African Wind Energy Task Force to coordinate regional policy development and implementation; developing a Regional West African Wind Energy Master Plan that sets out a coordinated deployment pathway to 2030 and 2050; implementing a phased approach to policy instruments, transitioning from feed-in tariffs (Phase 1) to competitive auctions (Phase 2) and ultimately to technology-neutral bidding (Phase 3); harmonising tax incentives across the region, including standardised import duty exemptions, VAT reductions, and income tax holidays; creating a Regional Renewable Energy Investment Fund to provide concessional finance and guarantee facilities; developing harmonised regional grid codes through the West African Power Pool (WAPP); establishing a regional wind energy training centre to build local technical expertise; and implementing a regional wind energy pilot project to demonstrate the feasibility of cross-border wind integration.

The future of West Africa's power sector lies in its coastal wind resources, but realising this potential depends on far-reaching policy reforms, institutional strengthening, and deeper regional cooperation. The harmonised policy framework proposed here provides an initial platform for this transformation and a credible pathway to unlock the region's substantial coastal wind energy potential.

Declarations

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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