ECREEE
TOWARDS SUSTAINABLE ENERGY

From Vision to Coordinated Action

Consolidation of SE4ALL Action Agendas, National Renewable Energy Action Plans, and National Energy Efficiency Action Plans of the ECOWAS region countries

September 2017

This consolidated report was funded by the European Union
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December 2017

ECREEE has joined forces with the EU to assist member states in advancing with planning for renewable energy and energy efficiency. For this reason the "EU's Technical Assistance Facility (TAF)" for the "Sustainable Energy for all" initiative was mobilised (Contract EuropeAid 2013/335152 - West and Central Africa) in order to assist the countries in developing their SE4ALL flagship documents.

ECREEE
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Foreword

The ECOWAS Region faces major energy challenges, despite the vast energy resources of its 15 Member States. Access to energy is low, energy insecurity is high, and climate change is already adversely affecting the region. Energy is therefore a critical challenge especially given the strong correlation between expansion in energy services and access and rapid economic growth, employment generation, poverty reduction and sustainable development.

ECOWAS Authorities recognised the fact that achieving the goals for energy access and energy security will require increased use of renewable energy, as well as increased efficiency in the use of energy. Harnessing the region's vast sustainable energy potential offers the prospect for expanded energy access and secure domestic energy supplies, efficient to meet and even exceed the targets set out in the regional sustainable energy goals by 2030. Similarly, aligned information is a fundamental constituent of this, and the Sustainable Energy for All (SE4ALL) Action Agendas, which have been developed within the SE4ALL initiative are an important step towards the alignment of information at technical, legislative and institutional levels.

ECREEE - with the support of the European Union's Technical Assistance Facility (TAF) - has worked on the regional data consolidation of the SE4ALL Action Agendas, which have also undergone national technical validation and the Quality Circle of SE4ALL.

The goal of this consolidation is to compile all national data and assess how these National Action Agendas translate to the regional policies in a strategic path aimed at ensuring the ECOWAS Region attains the objectives of the regional renewable energy and energy efficiency policies by 2030. It therefore provides information on the quantity of inputs required to meet the objectives in terms of number of electricity connections, number of access to efficient cooking fuels equipment and devices, MW of installed renewable energy capacity and penetration of energy efficient devices or energy efficiency savings.

The consolidation of the information contained in the Action Agendas and the Renewable Energy and Energy Efficiency Actions Plans, has revealed that the aggregated targets are moving towards the direction of set regional goals, therefore aligning to the regional policies for renewable energy and energy efficiency (EREP and EEEP). The current disparities, which are significant in many cases between countries, and even within the same country, have become apparent, indicating areas and gaps where interventions and actions are necessary.

Mr. Mahama Kappiah, Executive Director

ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

ECREEE will continue to support ECOWAS Member States in achieving national and regional sustainable energy objectives. The next step entails the publication of Member States' Investment Prospectuses (IPs). These IPs aim at operationalizing the Country Action Agenda, by identifying and developing a set of implementable programmes and projects, including their investment requirements, that can be presented to potential private and public investors.

We remain grateful to the ECOWAS Member States and our partners for the great collaboration and progress made in the ECOWAS Process and Strategy on the Development of the SE4ALL Action Agendas, National Renewable Energy Action Plans (NREAPs) and National Energy Efficiency Action Plans (NEEAPs).

It is my sincere hope that this Consolidation Report and its findings will strengthen our collective pursuit of sustainable energy development in the ECOWAS Region.

Mr. Mahama Kappiah

Executive Director
ECREEE

The EU has already provided and earmarked more than 1.1 billion EUR in the energy sector for the ECOWAS Region since 2007 and has been working as a close partner to ECREEE on several joint projects, studies and initiatives. In parallel the EU supported actively the SE4ALL initiative since its launch in 2012 an important driver that led to the embedment of SE4ALL objectives in the SDG No 7.

The energy and climate change sectors have been a priority in the portfolio of the EU's poverty alleviation and eradication strategies for many years and this is even more relevant today. The vulnerability of ECOWAS to climate change, calls for concrete advancements and action in climate change adaptation but also mitigation. Utilising the existing renewable energy resources is the key to such action but also in achieving both SGD7 and SGD13 by 2030 in the region. In parallel, sustainable energy is an emerging economic sector with high potential for growth and job creation, and allows the development of productive uses for energy.

In order to foster the development of sustainable energy in Africa, the EU has taken up this challenge in a systematic and coherent manner. In cooperation with all its international partners, the EU has developed a multi-level approach to face the challenges linked to energy poverty.

A number of joint declarations on sustainable energy cooperation have been signed with many ECOWAS Countries that have decided to work together closely with the EU and its member states in the energy field. The EU encourages comprehensive sector reforms, conducive policies as well as regulatory frameworks which are crucial and go hand in hand with the creation of an enabling environment for private investments.

Against this background, the European Union launched in 2013 the Technical Assistance Facility for the SE4ALL initiative TAF. The TAF has been supporting many ECOWAS member states in fine tuning their energy policies and regulatory frameworks to allow for increased investments in the energy sector and is facilitating the implementation of the investment projects needed to meet the SDG7 objectives of making modern energy services accessible to all.

We are particularly happy in this instance to have assisted the very motivated team of ECREEE with our TAF experts in creating this very useful consolidation document that can serve in coordinating actions and facilitate progress for planning for renewable energy, access and energy efficiency. The catalytic role of ECREEE in promoting sustainable energy, in creating partnerships and in diffusing knowledge is very much appreciated and presents a modern answer to the expressed policies of the ECOWAS Region to the energy sector.

The sustainable growth future of the ECOWAS Countries is closely linked to developing renewable energy sources. The EU will be at the side of ECOWAS Countries in their efforts to achieve the SDG7 and SDG13 goals.

Mr. Roberto RIDOLFI
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Acknowledgments

ECREEE would like to express its gratitude to all the stakeholders who contributed to the successful completion of the Consolidation Report of SE4ALL Action Agendas and Action Plans. In particular, ECREEE would like to thank its core partners for supporting the SE4ALL process in the ECOWAS Region. Special mention must be made of the Austrian Development Cooperation (ADA), the Spanish Agency for international Development Cooperation (AECID), the United Nations Industrial Development Organisation (UNIDO), the Global Environment Fund (GEF), the African Development Bank (AfDB) and the African SE4ALL Hub, the United Nations Industrial Development Organization (UNIDO), the German Cooperation (GIZ), and the European Union through the Supporting Energy Efficiency for Access in West Africa (SEEA-WA) project, for their support towards the successful consultation and development process of the country sustainable energy action plans by the ECOWAS Member States.

ECREEE is particularly grateful to the European Union Technical Assistance Facility (EU-TAF) for the financial support provided towards the elaboration of this Consolidation Report.

ECREEE would also like to thank the National Consultants that were engaged by ECREEE in each Member States, in consultation with the respective Ministry of Energy, to support the development of the SE4ALL Action Plans and Agenda, and the team of International Experts that also provided critical technical assistance to this effort.

The process of developing the National Renewable Energy and Energy Efficiency Action Plans and SE4ALL Action Agendas in the ECOWAS Region was made possible through the collaborative efforts of ECREEE and the Ministries of Energy of all 15 ECOWAS Member States. This endeavour clearly demonstrates the common commitment of Member States towards attaining the regional sustainable energy targets by 2020 and 2030.

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Contents

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Abbreviations & Acronyms

AA	Action Agenda
AFD	Agence Française de Développement
AFDB	African Development Bank
B / Bn	Billion
CARD	Country Action Reference Document
CEMG	Clean Energy Mini Grid
DEVCO	Directorate General for Development and Cooperation – EuropeAid
DFID	Department for International Development (UK)
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EDF	European Development Fund
EE	Energy Efficiency
EIB	European Investment Bank
EPC	Engineering, Procurement & Construction
ESIA	Environmental and Social Impact Assessment
EU	European Union
EUD	European Union Delegation
EUR / €	Euro
FiT	Feed in Tariff
GIS	Geographical Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GNI	Gross National Income
GoSL	Government of Sierra Leone
GW / GWh	Giga-Watts / Giga-Watt-hours
HIA	High Impact Action
HPP	Hydro Power Plant
HV	High Voltage
IBRD	International Bank for Reconstruction and Development
IFC	International Finance Corporation
IFI	International Financial Institution
IP	Investment Prospectus
IPP	Independent Power Producer

IPCC	Intergovernmental Panel on Climate Change
kW / kWh	kilo-Watt / kilo-Watt-hour
LV	Low Voltage
MCC	Millennium Challenge Corporation
MDG	Millennium Development Goal
MoU	Memorandum of Understanding
Mtoe (1)	Million toe (1 million toe = 11,65 MWh)
MV	Medium Voltage
MW / MWh	Mega-Watts / Mega-Watt-hours
NGO	Non-Government Organization
NIP	National Indicative Programme
PPA	Purchase Power Agreement
PPP	Public Private Partnership
PV	Photovoltaic
RAGA	Rapid Assessment/Gap Analysis
RE	Renewable Energy
REA	Rural Electrification Agency
REF	Rural Electrification Fund
SE4ALL	Sustainable Energy for All
SHP	Small Hydro Power
SME	Small Medium sized Enterprise
SSHP	Small-Scale Hydro Power
TAF	Technical Assistance Facility
T&D	Transmission and Distribution
ToR	Terms of Reference
UEMOA	Union Economique et Monétaires des Etats de l'Afrique de L'Ouest
UNDP	United Nations Development Programme
UNFCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
USD / $	United States Dollars
WAPP	West African Power Pool
WB	World Bank

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The SE4ALL Initiative

The SE4ALL initiative, launched by the UN Secretary General in 2011, is a multi-stakeholder partnership between governments, the private sector, and civil society, having three main objectives to be achieved by 2030:

- **Ensure universal access to modern energy services.**
- **Double the global rate of improvement in energy efficiency.**
- **Double the share of renewable energy in the global energy mix.**

The SE4ALL Country Action Reference Document (CARD) foresees the following steps for the implementation of SE4ALL Country Actions:

SUSTAINABLE ENERGY FOR ALL

The SE4ALL Action Agenda, the NREAP and the NEEAP are developed in a holistic and integrated approach.

All three plans are developed in a national stakeholder consultation process and are owned by the Government.

The SUSTAINABLE ENERGY FOR ALL initiative acts in support of the 2014 - 2024 decade of sustainable energy for all as declared by the UN general assembly.

Step 1

A Declaration of Partnership through which national governments express their desire to participate in the SE4ALL initiative;

Step 2

A Rapid Assessment/Gap Analysis, which describes the status quo regarding energy in the national development context, providing the political, economic, social, and environmental background for the subsequent drafting of strategic plans to promote SE4ALL in a particular country;

Step 3

- The **Action Agenda**. This is a strategy-driven and holistic document, which addresses the issues and gaps identified in the respective Rapid Assessment/Gap Analysis (RAGA) by outlining and prioritizing various courses of action and demonstrates how the three goals of SE4ALL can be achieved;
- The **Investment Prospectus**, which aims to provide an approach to operationalizing the Country Action Agenda, in each specific sector or subsector. This is done by identifying and developing a set of implementable projects and programmes, including their investment requirements, which can be presented to potential private and public investors.

SE4ALL Action Agenda

The **Action Agenda** for each country is intended to demonstrate how the SE4ALL global objectives can be achieved in a particular country in a specific timeline.

The **Action Agenda** addresses the issues and gaps identified in the Rapid Assessment/Gap Analysis for each country by outlining and prioritizing various courses of action.

The **Action Agenda** is intended to showcase the role of energy services in various sectors of the economy and become a tool in order to reach national development goals, while implementing effective and efficient organized actions targeting energy access, energy efficiency, and renewable energy sources.

SE4ALL National Action Agendas translate the national policies in a strategic path that will bring each country close to the SE4ALL objectives by 2030 (with milestones in 2015 and 2020). It provides information on the quantity of inputs required to meet the objectives in term of number of electricity connections, number of access to efficient cooking fuels equipment and devices, MW of installed renewable energy capacity and penetration of energy efficient devices. It also indicates the schedule of actions and programmes to roll out in order to create an enabling environment for the above investment.

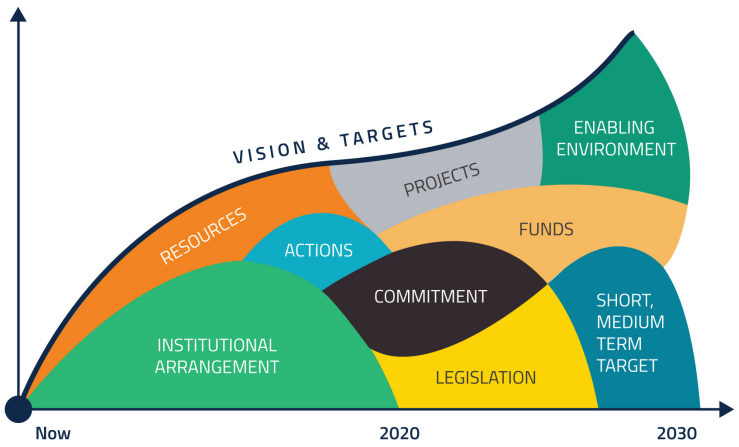
The Action Agenda provides information in terms of quantification of inputs required to meet the objectives, such as capacity (MW) of installed renewable energy, electricity connections, penetration of energy efficient devices, efficient cooking fuels equipment and devices and a lot more. It also aims to provide an indication of the schedule of actions and programmes necessary to be rolled out for the creation of an enabling environment for the necessary investments.

Link to the Investment Prospectus

Following the implementation of the Action Agendas and the Action Plans for Renewable Energy and Energy Efficiency, the **Investment Prospectus** intends to identify those actions and projects, that will facilitate the transition from the vision to the reality.

The Investment Prospectus (IP) is developed with the aim to operationalize the Action Agenda of each Country. It aims to help achieving the SE4ALL goals by identifying and developing a set of implementable programmes and projects, including their investment requirements. The Investment Prospectus makes programmes and projects visible to potential private and public investors.

The Investment Prospectus is a time-bound short-to-medium term document presenting an integrated set of prioritized and sequenced investment opportunities. It integrates the technical, financial, and implementation requirements for achieving an intermediate goal and delineates the annual funding requirements for capital investments, technical assistance and capacity building over a given time frame. It also identifies policy frameworks or government priorities relevant to reaching these outcomes.



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ECOWAS Centre for Renewable Energy and Energy Efficiency

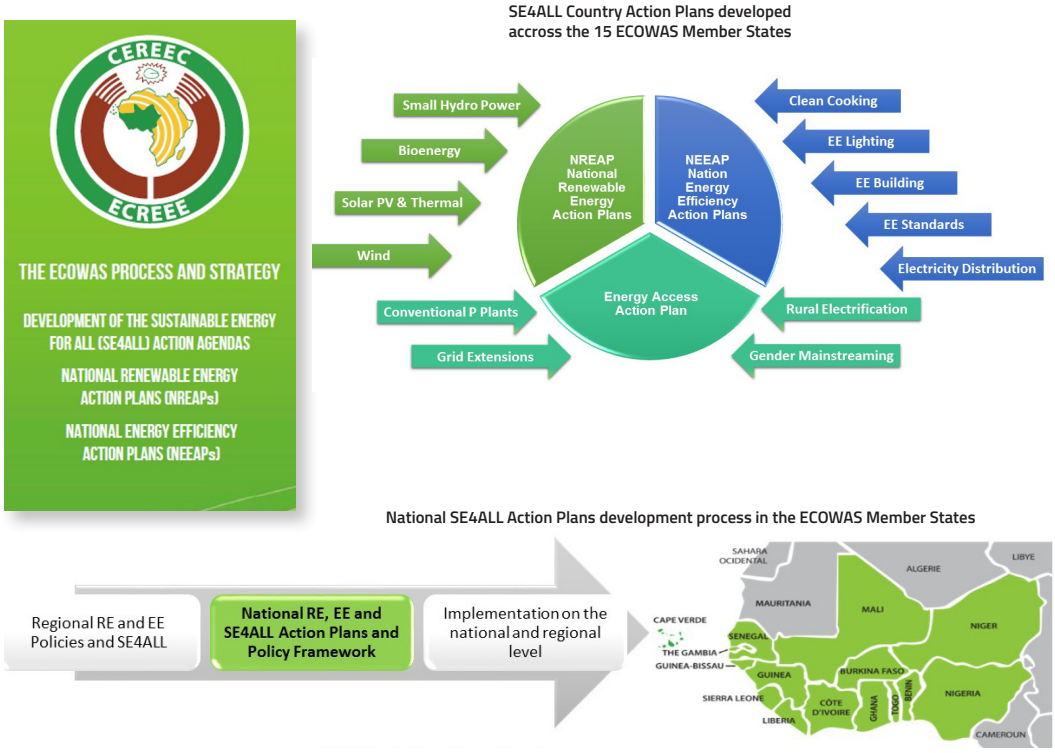
ECREEE is the ECOWAS Centre for Renewable Energy and Energy Efficiency that is based in Cabo Verde. This institution was established by the ECOWAS Council of Ministers with the mandate to promote renewable energy and energy efficiency markets. ECREEE is supported and has got the legitimacy from the Governments of Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo (15 countries of ECOWAS).

ECREEE coordinates, executes, co-funds and supports programs, projects and activities in the scope of the four following strategic areas: Sustainable Energy Policy, Capacity building, Knowledge Management and, Investment Project development and finance. One of the major pillars is the capacity building programmes that would help promote access, rural electrification, renewable energy and energy efficiency. ECREEE has developed a considerable amount of work in the field of capacity building through many workshops and training programmes at regional level in the rural electrification and energy efficiency.

The ECOWAS Authorities mandated ECREEE to act as the SE4ALL Focal Point in the West Africa region. Against this background, ECREEE has embarked upon the regional SE4ALL program, which aims to develop, in consultation with Member States, activities that are in alignment with national and regional strategies. The activities are executed in consultation with the SE4ALL Global Facilitation Team (GFT) in Vienna, the SE4ALL Hubs and all relevant partners.

ECOWAS has set up ambitious policy targets in terms of energy access, renewable energy and energy efficiency, so to support the region's efforts, ECREEE developed the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP) that were adopted by the ECOWAS Ministers in October 2012. Since then, ECREEE has been facilitating and monitoring the implementation of the regional policies, at the national level, among all ECOWAS Countries. These regional policies have included an obligation for the countries to propose national action plans and measures which respond to the set regional targets by 2030.

ECREEE in the period 2014-2016, has been assisting the ECOWAS member states in developing their respective SE4ALL National Action Agendas, including, the National Renewable Energy Action Plans (NREAPS) and the National Energy Efficiency Action Plans (NEAPS), supporting Member States to institutionalize actions promoting investments in sustainable energy services. In order to assure a credible and effective process, ECREEE engaged national consultants in each Member State - as well as a pool of international experts - to support the development of the Action Agendas and the Action Plans, which provides a roadmap for countries, in order to allow them to achieve their national targets, and in so doing, contribute towards the attainment of the regional sustainable energy tar-gets by 2020 and 2030.



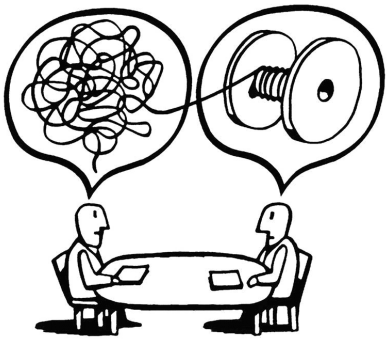
The Action Agendas consolidation exercise

The Action Agendas and the corresponding Action Plans for Renewable Energy and Energy Efficiency aim to bring, to the maximum possible extent, information for all ECOWAS Countries at the same level.

The kind, type and even the time and format of the information to be made available is an important constituent for the assessment of current status of the energy sector in the Region.

To bring at the same level, information from all 15 countries, all Action Agendas which have been elaborated and relevant supportive RE and EE Action Plans have shared the same template.

It has to be understood, though, that data and information was not always available for all countries. Besides some figures presented in the Action Agendas may have evolved since the AA's political validation, if new policies have been put in place for example.



The consolidation of the SE4ALL AA, NREAP and NEEAP reports of the 15 ECOWAS Member States aims at showing regional trajectories for Renewable Energy and Energy Efficiency, and provides information and directions on achieving the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP).

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INTRODUCTION

The energy system of West Africa is facing serious interrelated challenges of energy access, energy security and climate change adaptation and mitigation. Furthermore, during the last years the ECOWAS Region has gone through an energy crisis that hampers social and economic development, and affects particularly low-income population groups. To address these multiple challenges, ECOWAS has taken action to adopt and implement a Renewable Energy Policy and an Energy Efficiency Policy in 2012.

The ECOWAS Renewable Energy Policy aims to ensure increased use of renewable energy sources such as solar, wind, small-scale hydro and bioenergy for grid electricity supply and for the provision of access to energy services in rural areas. The policy scenario will complement other important conventional sources for power production (e.g. large hydro and natural gas). The policy primarily focuses on the electricity sector, but also considers some additional issues regarding the use of heat in the domestic energy sector. The specific objective of the renewable energy policy is to increase the share of renewable energy in the region's overall electricity mix to 10% in 2020 and 19% in 2030. Including large Hydro, the share would reach 35% in 2020 and 48% in 2030. Around 25% of the rural ECOWAS population will be served by Mini-Grids and standalone systems by 2030.

The ECOWAS Energy Efficiency Policy aims to implement measures that free 2,000 MW of power generation capacity and in the long term, more than double the annual improvement in energy efficiency, so as to attain levels comparable to those of world leaders.

To achieve Regional Development through the expressed vision and goals, it is essential to define a starting point, which will serve as a point of reference when assessing the effect of polices, practices or actions at regional or local level. A fundamental question would, then be: **Where do we stand now, and how can we meet our vision?** The Action Agenda, while providing a snapshot of the energy situation in a given country, provides the strategy that will serves as an umbrella plan for national energy sector development across SE4ALL's objectives of energy access, renewables and energy efficiency until 2030. Once an Action Agenda is politically adopted, it becomes the national implementation framework under which sectoral policies are elaborated.

The Action Agendas and the supporting Action Plans for Renewable Energy and Energy Efficiency in all ECOWAS Member States, provide information on a coordinated regional route for development, taking into account each country's possibilities and ambitions.

1. BASIC AND BACKGROUND INFORMATION

Approximately 28% of the African population lives in the ECOWAS Region, which covers a bit more than the 13% of the African Continent. The overall population of the Region is approximately 340 million compared to 1.2 billion people living in Africa. Population grows at a rate of approximately 2.7% on a yearly basis and is expected to reach almost 500 million by 2030[1&2]. (see figure 1 with the population density map of Africa)

West Africa has a wide variety of physical environments. The atmosphere in this region ranges from the tropical rainforests in Liberia to arid deserts in the North of Niger and Mali. These physical characteristics, besides differentiating the available endogenous Energy resources in the countries, they also lead to different priorities as regards their exploitation to serve populations dispersedly distributed in the area, especially in rural areas.

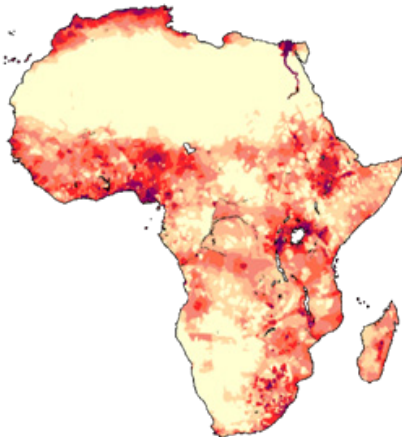

Figure 1 *Population density map of Africa*[3]

1.1 Population

More than half of the population in the region lives in Nigeria (≈53%), whose Gross Domestic product accounts for more than 75% of the Regional GDP (figures 2&3).

The population of the region is expected to reach half a billion people by 2030, and it seems that there will be a shift to urbanization by that year[4]. While, currently, urban population accounts for 45%, urban population is expected to reach 50% of the total population in 2030 as displayed in table 1.

1 REPORT TO ECOWAS, BEYOND 2020: CRISIS DRIVERS IN WEST AFRICA'S FUTURE (http://www.humanitarianfutures.org/wp-content/uploads/2013/06/Report-to-ECOWAS-Beyond-2020-Crisis-Drivers.pdf)

2 http://www.worldometers.info/world-population/western-africa-population/

3 http://theprepaideconomy.com/post/78120384253/heat-map-showing-population-density-across-africa

4 Sources of information:
- National Statistical Services
- Action Agendas, NREAPs, NEEAPs
- Humanitarian Futures Programme, http://www.humanitarianfutures.org/wp-content/uploads/2013/06/Report-to-ECOWAS-Beyond-2020-Crisis-Drivers.pdf

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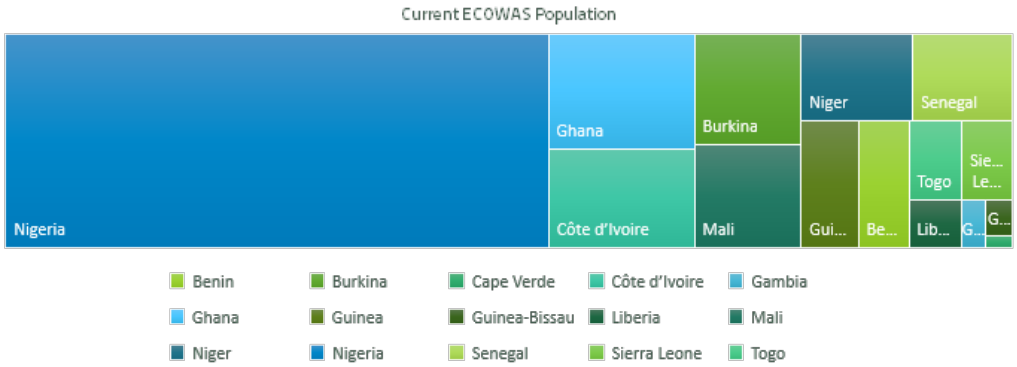
Figure 2 *Distribution of population among ECOWAS Countries*



Source: National Action Agendas and Statistical Services of ECOWAS Countries

Table 1 *Population of the ECOWAS Countries (Current and projected in 2030)*

	Population (Current) ('000 people)					Population (2030) ('000 people)			
	Total	**Urban**		**Rural**		**Urban**		**Rural**	
Benin	**10,008.749**	5,057.061	51%	4,951.68	49%	11,755.177	66%	6.150.00	34%
Burkina	**18,540.494**	5,562.148	30%	12,978.34	70%	6,941.220	33%	14,092.78	67%
Cabo Verde	**491.683**	303.673	62%	188.01	38%	72.500	9%	735.50	91%
Côte d'Ivoire	**22,671.331**	11,408.413	50%	11,262.91	50%	7,401.535	26%	20,686.46	74%
Gambia	**1,882.450**	n.a.	n.a.	n.a.	n.a.	2,321.065	71%	948.04	29%
Ghana	**26,300.000**	13,893.348	53%	12,406.65	47%	22,149.398	65%	12,084.60	35%
Guinea	**11,505.768**	3,210.109	28%	8,293.35	72%	7,858.620	49%	8,311.38	51%
Guinea-Bissau	**1,449.230**	573.533	40%	875.69	60%	943.770	39%	1,501.23	61%
Liberia	**3,887.886**	1,516.276	39%	2,371.61	61%	5,345.000	62%	3,290.00	38%
Mali	**17,227.301**	4,213.846	24%	13,013.45	76%	9,221.916	30%	21,314.23	70%
Niger	**15,203.822**	3,101.580	20%	12,102.24	80%	6,600.000	35%	12,100.00	65%
Nigeria	**182,281.962**	90,552.962	50%	91,729.00	50%	146,447.583	55%	120,552.41	45%
Senegal	**13,508.715**	6,102.800	45%	7,405.91	55%	8,185.413	42%	11,368.58	58%
Sierra Leone	**6,190.280**	2,414.209	39%	3,776.07	61%	3,769.665	40%	5,654.49	60%
Togo	**6,647.702**	2,542.934	38%	4.,104.76	62%	4,224.792	42%	5,724.01	58%
	337,797.37	**150,452.89**	**45%**	**185,459.72**	**55%**	**243,237.65**	**50%**	**244,513.73**	**50%**

Source: National Statistical Services; Action Agendas, NREAPs, NEEAPs; Humanitarian Futures Programme: http://www.humanitarianfutures.org/wp-content/uploads/2013/06/Report-to-ECOWAS-Beyond-2020-Crisis-Drivers.pdf

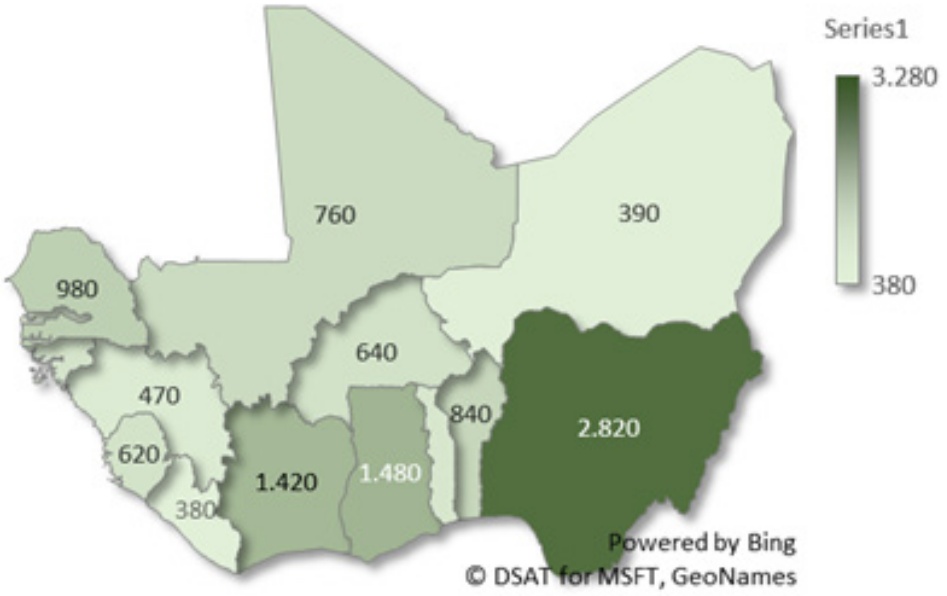
1.2 GDP / GNI (current)

There are large differences between the countries in terms of GDP, but most importantly the per capita Gross National Income (GNI) per capita, which ranges between the low 380 USD/capita in Liberia up to 3,280 USD in Cabo Verde, with eleven (11) countries having GNI lower than 1,000 USD/capita in 2015[5]. These differences, besides displaying the level of the economy for each country, indicate also the level of effort required for the ECOWAS Countries to converge in terms of development. Almost 75% of the regional GDP belongs to Nigeria, which is also, in terms of GNI at the high end of the region.

Figure 3 *Distribution of Gross Domestic Product (GDP / billion USD) among ECOWAS Countries (2015)*

Source: World Bank Country Databases: http://data.worldbank.org/

Figure 4 *Gross National Income per capita (GNI / capita USD 2015) of ECOWAS Countries*



Source: World Bank Country Databases: http://data.worldbank.org/

5 http://data.worldbank.org/

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1.3 Access to Electricity

The overall access to Electricity in the ECOWAS Region is approximately **45%**, equivalent to **150 million people**, with the majority of the people that have access to electricity living in urban areas. The electricity access rate in the urban areas is approximately **65%**, while in the rural areas, the access rate is just over **25%**. Figure 5 displays the large differences between the electrification rates of the ECOWAS Countries, as well as the large differences between urban centres and rural areas. In countries such as Benin or Togo and Guinea, for instance, these differences are substantial (between 50-60% in urban areas and around 5% in rural areas), while in other countries electrification rates are more balanced (e.g. Cote d'Ivoire, Ghana). (Note: Base year for the Access to Electricity information differ from country to country and range between 2013 and 2015, except for Niger (2010), Gambia (2011) and Guinea (2012). For Ghana, Senegal, Sierra Leone and Togo base year is 2013, for Cabo Verde, Cote d'Ivoire, Guinea Bissau and Mali is 2014 and for Benin, Burkina Faso and Liberia is 2015).

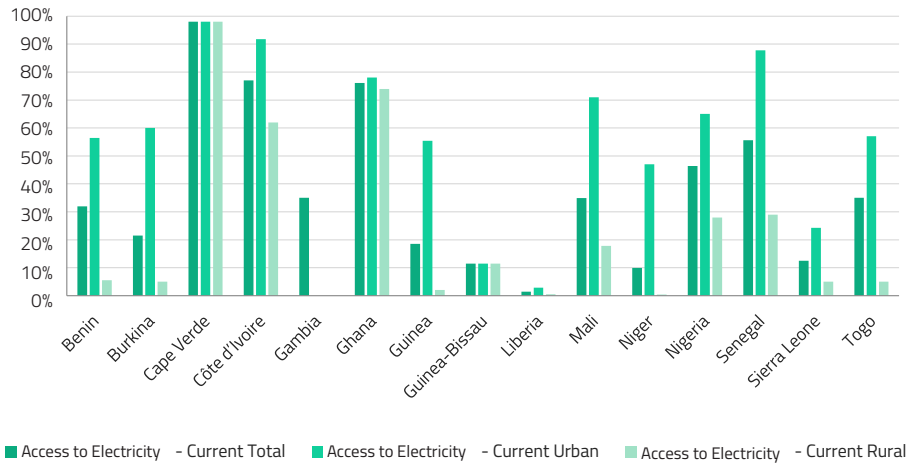
Energy Access

Energy access can be defined as the universal and affordable access to modern means of energy. It implies access to modern cooking solutions defined as relying primarily on non-solid fuels for cooking. It also implies access to electricity involves more than a first supply to the household; definition of access also involves consumption of a specified minimum level of electricity, the amount varies based on whether the household is in a rural or an urban area. The initial threshold level of electricity consumption for rural households is assumed to be 250 kilowatt-hours (kWh) per year and for urban households it is 500 kWh per year. The higher consumption assumed in urban areas reflects specific urban consumption patterns. Both are calculated based on an assumption of five people per household. In rural areas, this level of consumption could, for example, provide for the use of a floor fan, a mobile telephone and two compact fluorescent light bulbs for about five hours per day. In urban areas, consumption might also include an efficient refrigerator, a second mobile telephone per household and another appliance, such as a small television or a computer.

The definition of energy access also includes provision of cooking facilities which can be used without harm to the health of those in the household and which are more environmentally sustainable and energy efficient than the average biomass cookstove currently used in developing countries. This definition refers primarily to biogas systems, liquefied petroleum gas (LPG) stoves and improved biomass cookstoves that have considerably lower emissions and higher efficiencies than traditional three-stone fires for cooking.

(*) http://www.worldenergyoutlook.org/resources/energydevelopment/definingandmodellingenergyaccess/

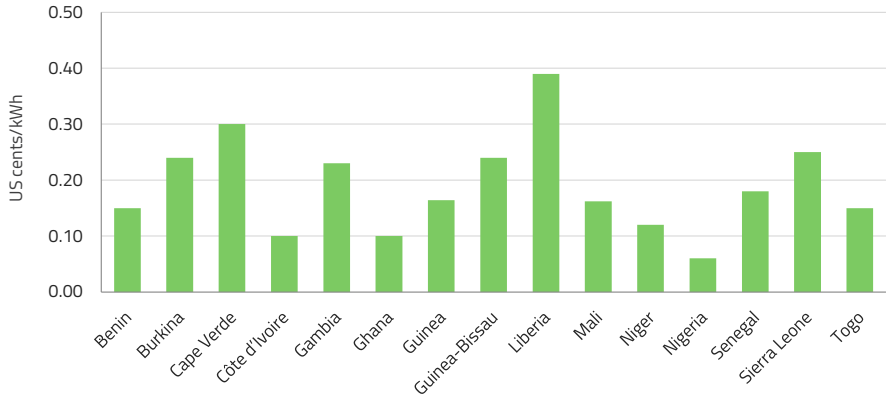
Figure 5 *Electricity access rates in urban and rural areas, and country overall rates*



http://www.worldenergyoutlook.org/resources/energydevelopment/definingandmodellingenergyaccess/

Figure 6 displays the average electricity prices that people pay for each kWh in the ECOWAS Countries, in the interconnected system. Large differences between countries exist, from the low 6-7 cents in Nigeria to almost 40 cents in Liberia. In countries such as Benin, Niger, electricity is kept at levels close to 10 cents as they are importing Electricity from neighbouring countries, mainly Nigeria.

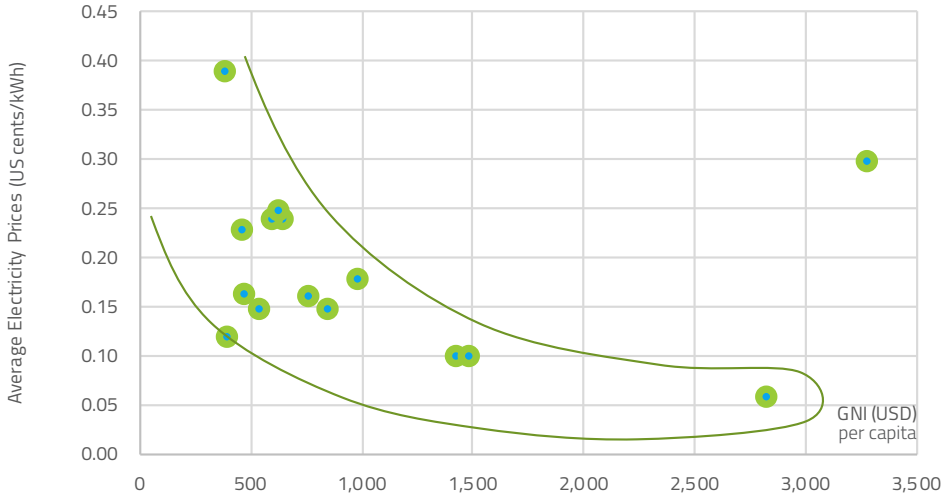
Figure 6 *Average electricity prices per kWh in the ECOWAS Countries (US cents/kWh)*



Source: Action Agenda for Burkina, Cape Verde and Senegal. For other countries various sources where consulted.

At the same time, the countries that pay higher prices for Electricity, are those whose per Capita Gross National Income (GNI) is at the low end, with the exception of Cabo Verde, displaying an inter-relationship between electricity prices and GNI per capita as displayed in figure 7.

Figure 7 *Correlation between average electricity prices and GNI per capita*



Source: Action Agenda for Burkina, Cape Verde and Senegal. For other countries various sources where consulted.

The issue of affordability for purchasing electricity is displayed in Figure 8. Besides Nigeria, where electricity prices are at the low end, and GNI/capita is the second highest in the Region, and Cabo Verde, where the electricity prices are high due to the extensive use of oil products for electricity production, the rest of the countries are split in two segments, one with an "ability" to buy around 10,000 kWh per year and another at the low end, with an "ability" to buy between 1,000 and 3,000 kWh per year. Similarly, Figure 9 presents the amount to be paid for a consumption of 100 kWh per month for each one of the countries.

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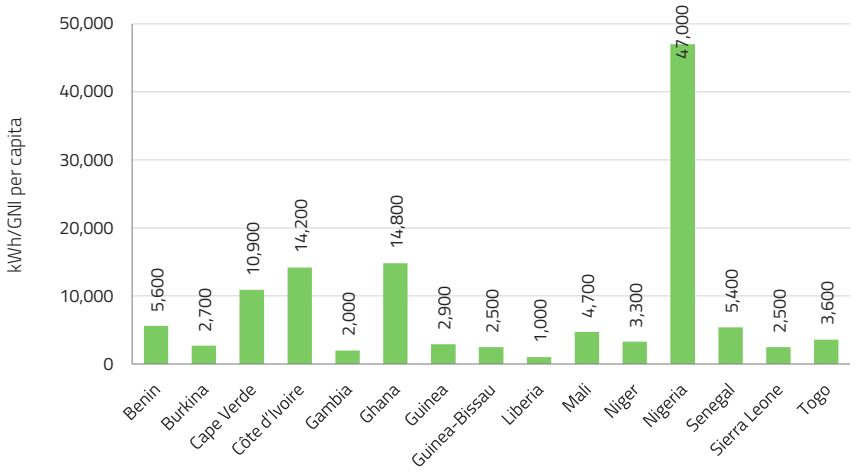
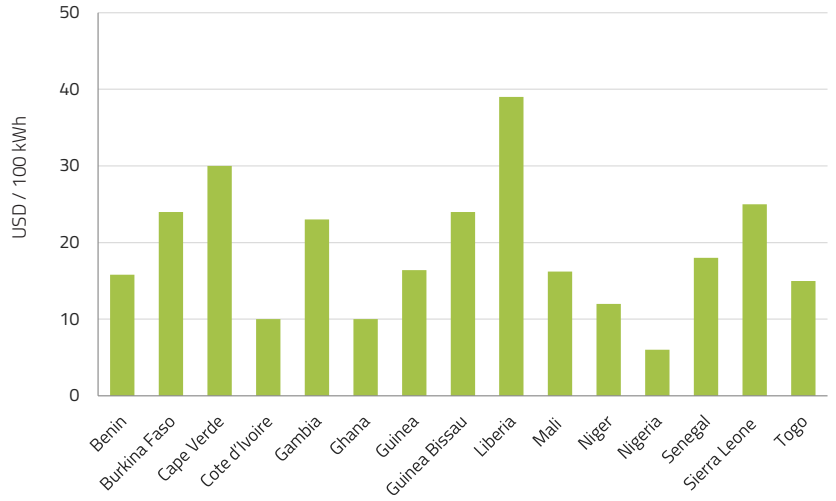
Figure 8 *Affordability measured by amount of electricity that GNI per capita can buy*



Source: Own elaboration based on data presented above

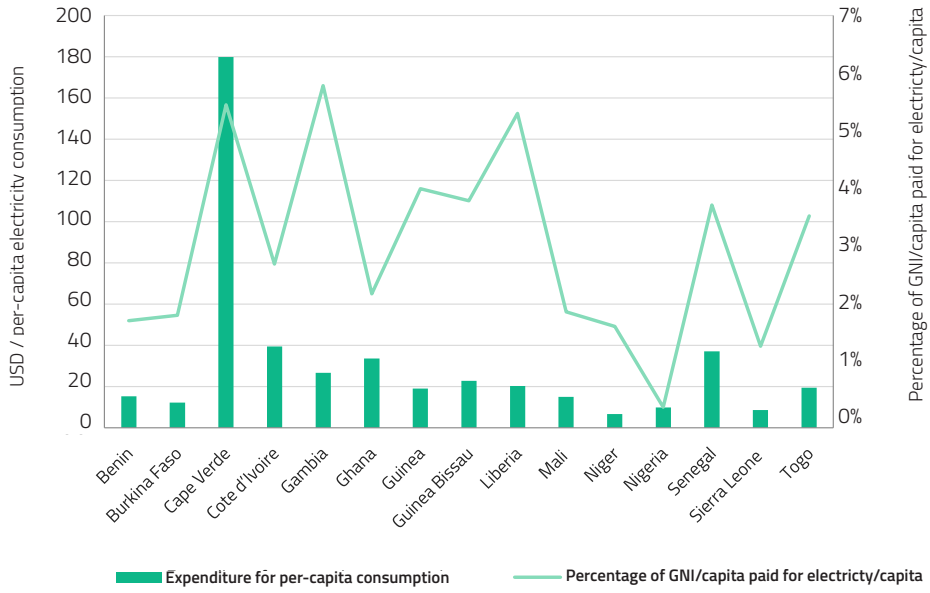
Figure 9 *Cost for the consumption of 100 kWh*



Source: Own elaboration based on data presented above

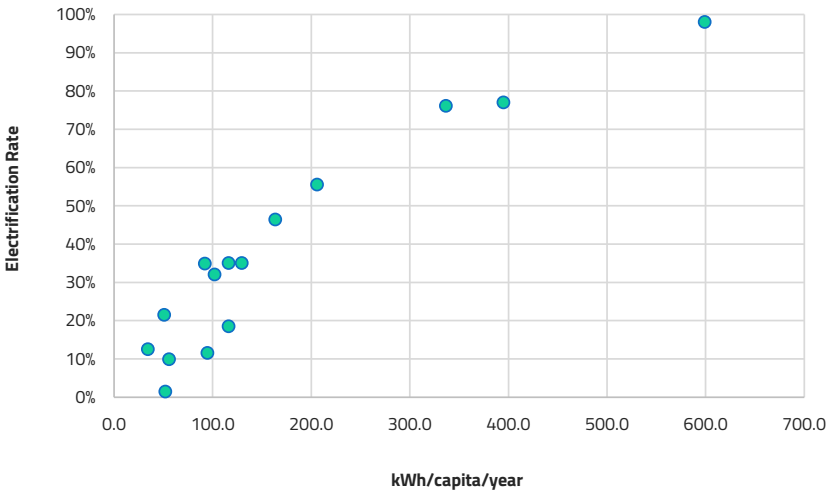
Figure 10, displays the yearly per capita expenditure for electricity, which has taken into consideration the current per capita electricity consumption of the ECOWAS country members and the electricity prices in each country, as well as the percentage of GNI per capita spent for Electricity per year (refer to Figure 6), whereas Figure 11 displays the strong relationship between the availability of electricity (Electrification rate) and the per capita electricity consumption.

Figure 10 *Yearly expenditure for the per capita electricity consumption*



Source: Own elaboration based on data presented above

Figure 11 *Relation between electrification rate and annual per-capita electricity consumption*



Source: Own elaboration based on data presented above

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1.4 Power Generation in the Region

Installed Generation Capacity

Although there is a considerable fleet of generation facilities in the Region - estimated to be approximately 21 GW - only almost half of it is operational. In addition, several production facilities are functioning at much lower than their nominal capacity. The most apparent case is Nigeria, having 12.5 GW of installed capacity, of which only 3.8 GW is operational[6]. To a lesser extent the same applies to Ghana[7] (3.3 GW vs 2.8 GW), Mali[8] (488 MW vs 360 MW) or Benin[9] (327 MW vs 147 MW).

Renewable Energy installed capacity (which is mostly Hydroelectric capacity) is also not fully operational in the Region. Of the 1,930 MW of installed capacity in Nigeria, only 440 MW are reported as operational. Similar situation applies to Benin, where 15 MW out of the installed 65 MW are operational, and to Mali with 183 MW operational out of 312 MW installed capacity.

Installed capacity versus Operational capacity is presented in Table 2 and Figure 12. It should be noted, though, that not all countries have provided specific information for installed and operational capacity, therefore both installed and operational capacity are reported at the same level for several countries.

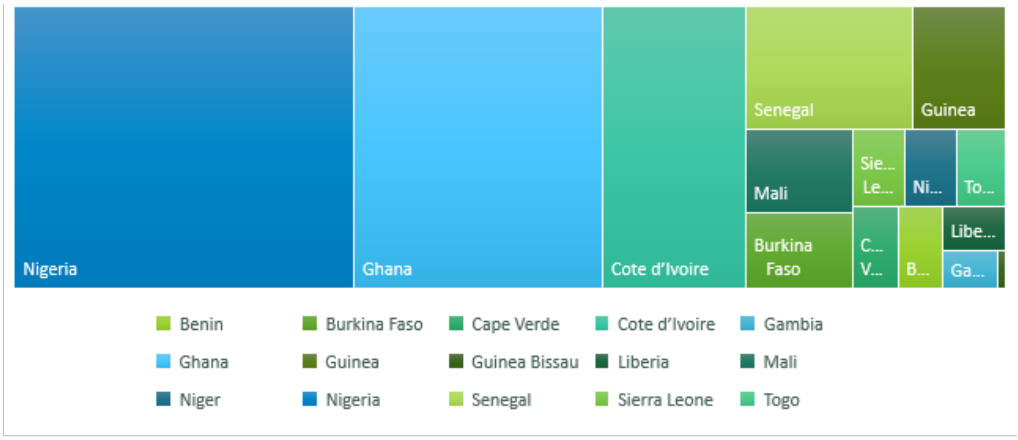
Table 2 *Installed vs operational capacity in the ECOWAS Countries*

		Total Current Capacity		Total RE Current Capacity	
		Total Current Generation Capacity	Operational Capacity	Current RE Generation Capacity	Operational RE Generation Capacity
	year	MW	MW	MW	MW
Benin	2016	327	147	65	15
Burkina Faso	2015	325	325	32	32
Cabo Verde	2015	153	153	7.7	7,7
Cote d'Ivoire	2014	1,632	1,632	604	604
Gambia	2015	85	85	1	1
Ghana	2014	3,325	2,830	1,588	1,588
Guinea	2012	338	158	137	
Guinea Bissau	2015	11	11	0	
Liberia	2016(*)	22	22	4	4
Mali	2015	488	360	312	183
Niger	2015	159	159	4	4
Nigeria	2014/5(*)	12,522	3,879	1,930	444
Senegal	2014	834	834	81	81
Sierra Leone	2014	163	163	59	59
Togo	2013	154	154	67	67
		20,723	10,906	4,891	3,089

* In Liberia, approximately additional 92 MW are operated by auto-producers. In addition, 88 MW are to be added to the network as Mt Coffee Hydro project is being rehabilitated and expected to be fully operational in 2017, http://mtcoffeeliberia.com/
* for Nigeria, overall capacity including diesel.

6 https://www.giz.de/en/downloads/giz2015-en-nigerian-energy-sector.pdf
7 http://www.ecgonline.info/index.php/about-the-power-sector-in-ghana.html
8 https://www.edm-sa.com.ml/index.php/2014-06-27-10-06-12
9 http://www.cebnet.org/production/production-hydroelectrique and https://www.sbee.bj/site/nos-activites/production-delectricite/

Figure 12 *Current operational capacity - 11 GW*



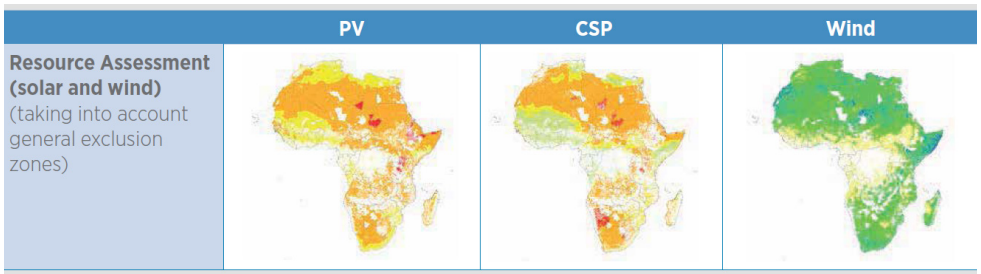
Source: Own elaboration based on data presented above

1.5 Renewable Energy in the Region

1.5.1 Renewable Energy Potential and Availability in the Region

In the "Baseline Report for the ECOWAS Renewable Energy Policy"[10], published in 2012, information is provided on the Western Africa's Renewable Energy Potential, being both considerable and diversified between countries. On the other hand, the poor Transmission and Distribution (T&D) infrastructures, geographical issues, among other factors do not allow this potential to become easily and efficiently available to the end users. In the IRENA study "Estimating the Renewable Energy Potential in Africa, A GIS-based approach", published in 2014[11], an assessment of the RE potential (photovoltaic, CSP, wind and biomass) is performed, taking into account certain geographical and technical restriction criteria, to provide geographic or technical potential[12]. In addition, criteria such as distance to urban areas, distance to existing grid lines, market access, water availability have also been used. Figure 13 displays the resource potential "suitability" combined with exclusion criteria for solar and wind technologies. Such information can be viewed in https://irena.masdar.ac.ae/gallery/#gallery.

Figure 13 *Resource potential "suitability" combined with "exclusion" criteria*



Source: IRENA "Estimating the Renewable Energy Potential in Africa, A GIS-based approach", 2014

10 http://www.euei-pdf.org/sites/default/files/field_publication_file/ecowas_baseline_report_en.pdf

11 http://www.irena.org/DocumentDownloads/Publications/IRENA_Africa_Resource_Potential_Aug2014.pdf

12 The geographic potential may be seen as an intermediate step towards calculating the technical potential of renewable energy resource. The geographic potential takes into account areas which are suitable and usable for specific renewable energy employment. Depending on the details of available geographic data, an appropriate set of exclusion criteria can be set to realistically estimate the available land area (e.g. exclusion of urban areas for large scale wind power production, protected land, sloped areas, water bodies). The technical potential is the geographic potential minus the losses from conversion into secondary energies and constrained by the requirements related to large-scale installation (e.g. spacing factors representing spacing and servicing areas of solar power plants or wind turbines, as well as (grid-) transportation losses). Technological, structural, ecological, and legislative restrictions and requirements, are accounted for. The calculation of the technical potential of bioenergy sources is additionally complex as the resulting product or "harvest" is subject to further conversion processes. Depending on the type of bio crop produced, these conversion processes may range from simple combustion to advanced conversion processes.

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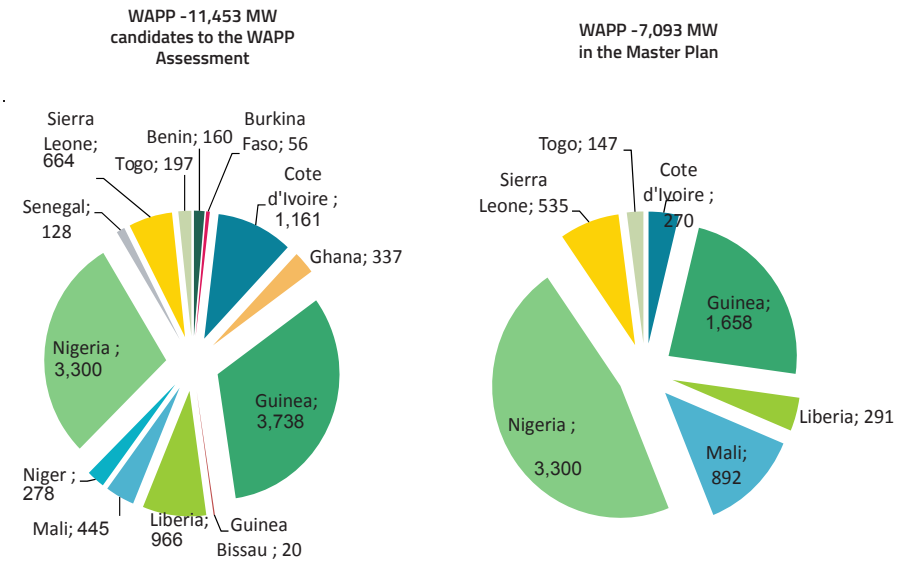
Hydropower

The overall hydroelectric potential (small, medium and large scale), located in the fifteen ECOWAS Countries, is estimated at around 25,000 MW. It is assessed that only around 16% has been exploited. Around half of the existing large potential (around 11.5 GW) has been assessed technically and economically in the course of the elaboration of the 2011 Master Plan of the West African Power Pool (WAPP)[13], as displayed in Figure 14.

Finally, a project pipeline of 21 large hydro power projects with an overall capacity of 7.0 GW has been approved for execution by the WAPP. It is projected that large hydropower will satisfy 25% of the overall installed electric capacity in the ECOWAS Region by 2025 and 29% by 2030. The implementation of the WAPP project pipeline and attached transmission lines will allow regional power trade, and can potentially lower the generation costs and consumer tariffs, particularly in countries highly dependent on expensive diesel generation today. The implementation of WAPP and accompanying project will also potentially alleviate several of the technical constraints, as referred in the previous paragraph.

Figure 14 *Renewable energy candidates in the WAPP Resource Assessment and in the approved Master Plan*



Source: Master Plan of the West African Power Pool (WAPP), 2011

The estimations of the **SSHP potential** (up to 30 MW) in the ECOWAS Region differ widely and lack reliability. They range from 1,700 MW and 5,700 MW of feasible potential. Due to the lack of available hydrological data in the countries it has been difficult to provide a comprehensive updated overview. In many countries the inventories established some decades ago, have not been updated and gauging stations do not exist anymore. Many resource assessments have been carried out during the 70ies, 80ies and 90ies by different foreign consultants (e.g. EDF for the French speaking countries) and the regional expertise in hydro resources assessment is poor, if any. A compilation of several data sources is summarized in the following table (source: Baseline Report for the ECOWAS Renewable Energy Policy -EREP) (Table 3). Similar assessment has been performed by IRENA, 2012 as displayed in Table 4 (https://www.irena.org/DocumentDownloads/Publications/Prospects_for_the_African_PowerSector.pdf).

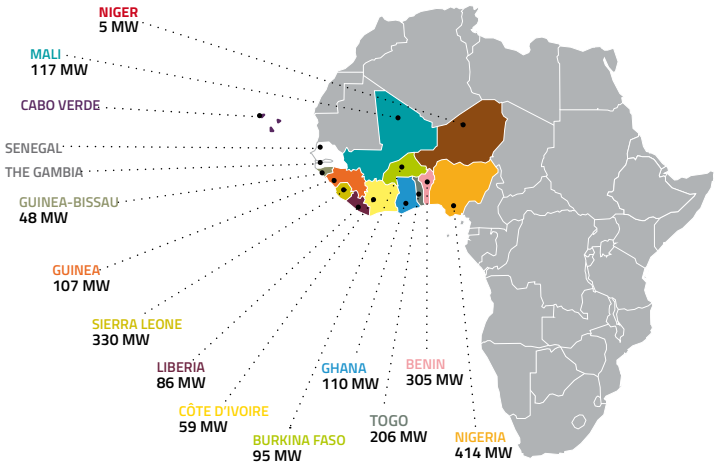
13 http://www.ecowapp.org/

Table 3 *Assessment of hydro capacity potential in the ECOWAS Region*

Countries	All hydro candidates assessed by the WAPP in MW	WAPP projects in the Master Plan in MW	No. of sites of less than 30 MW	SSHP potential (<= 30 MW) in MW	Remarks on SSHP potential
Benin	160		102	307	-
Burkina Faso	56		70	138	
Cape Verde					-
Cote d'Ivoire	1,161.5	270	5	58	-
Gambia				No information available	
Ghana	337		69	512	all < 2 MW
Guinea	3,738.7	1,658	10	17	+ 4 pico
Guinea Bissau	20		2	48	-
Liberia	966,5	291	24	66	-
Mali	445,9	892	15	70	-
Niger	278.5		5	About 30	-
Nigeria	3,300	3,300	65	370	-
Senegal	128			no information available	
Sierra Leone	664.4	535	17	330	-
Togo	197	147	40	229	-
Total	**11,453.5**	**7,093**	**424**	**1,672**	

Source: Baseline Report for the ECOWAS Renewable Energy Policy (EREP)

Estimated Small-Scale Hydropower Potential



Source: http://www.ren21.net/Portals/0/documents/activities/Regional%20Reports/ECOWAS_EN.pdf

Table 4 *Small Scale Hydro Potential (SSHP): <10 MW*

Country	MW
Benin	1,045
Burkina Faso	139
Ghana	8
Gambia, Guinea, Guinea Bissau, Senegal	1,140
Liberia	1,000
Mali	115
Niger	273
Nigeria	734
Sierra Leone	38

Source: http://www.ren21.net/Portals/0/documents/activities/Regional%20Reports/ECOWAS_EN.pdf

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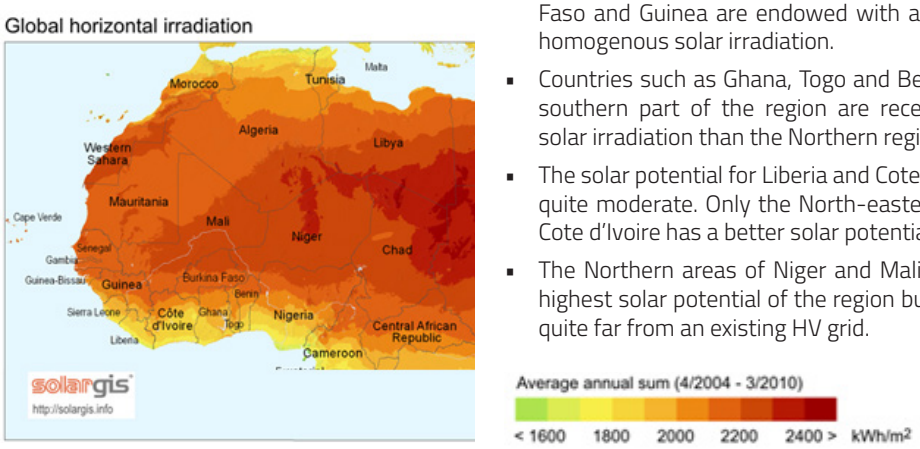
Solar Power

The "ECOWAS baseline report" provides a starting point for the assessment of the solar potential in the region (http://www.euei-pdf.org/sites/default/files/field_publication_file/ecowas_baseline_report_en.pdf). The production of electricity potential in the Region has been estimated between 1,110 at the south part of Nigeria and 1,730 kWh/kWp (fixed systems) at the northern parts of Mali and Niger (or between 1,540 and 2,470 hours respectively). The solar irradiation map (Figure 15), displays these differences existing in the region. Depending on the uniformity of solar irradiation across each country's territory, the ECOWAS Countries, can be divided in 4 groups.

Figure 15 *Photovoltaic potential in the Region*

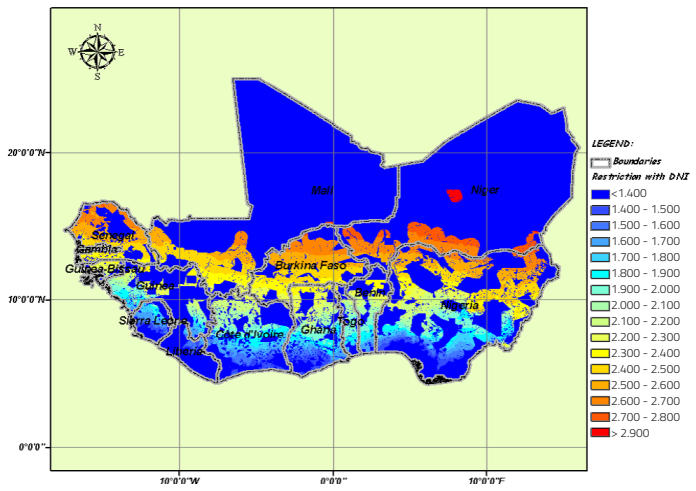


- Senegal, The Gambia, Guinea Bissau, Burkina Faso and Guinea are endowed with a relatively homogenous solar irradiation.
- Countries such as Ghana, Togo and Benin in the southern part of the region are receiving less solar irradiation than the Northern regions.
- The solar potential for Liberia and Cote d'Ivoire is quite moderate. Only the North-eastern part of Cote d'Ivoire has a better solar potential.
- The Northern areas of Niger and Mali have the highest solar potential of the region but in areas quite far from an existing HV grid.

CSP potential

ECREEE in cooperation with CENER in Spain has launched a CSP potential assessment[14] which is based on Solar Direct Normal Irradiance (DNI) data. First results show that around 87% of the total surface of the ECOWAS Region has long term annual DNI values greater than 1,800 kWh/m^2 and would have theoretically sufficient potential for CSP development. However, due to scarcity of transmission and distribution infrastructure, only some sites are technically feasible. The non-blue in the graph below are considered feasible areas (Figure 16).

Figure 16 *CSP potential mapping*

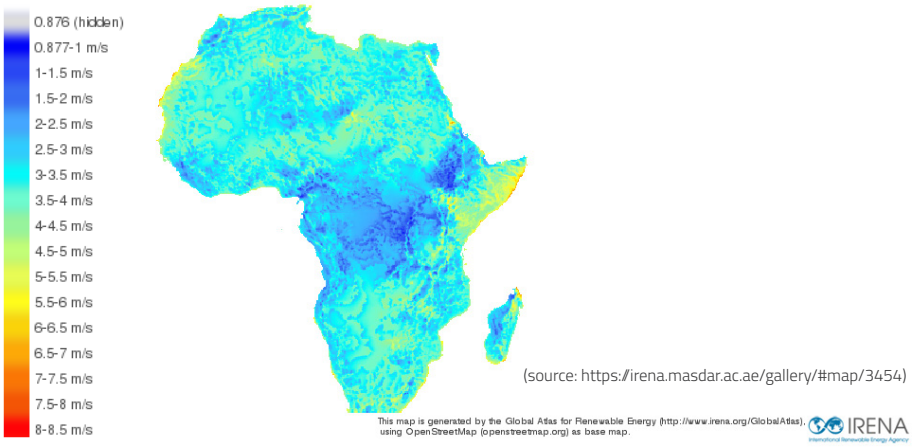


14 Baseline Report for the ECOWAS Renewable Energy Policy (EREP), Final draft, 23 October 2012

Wind

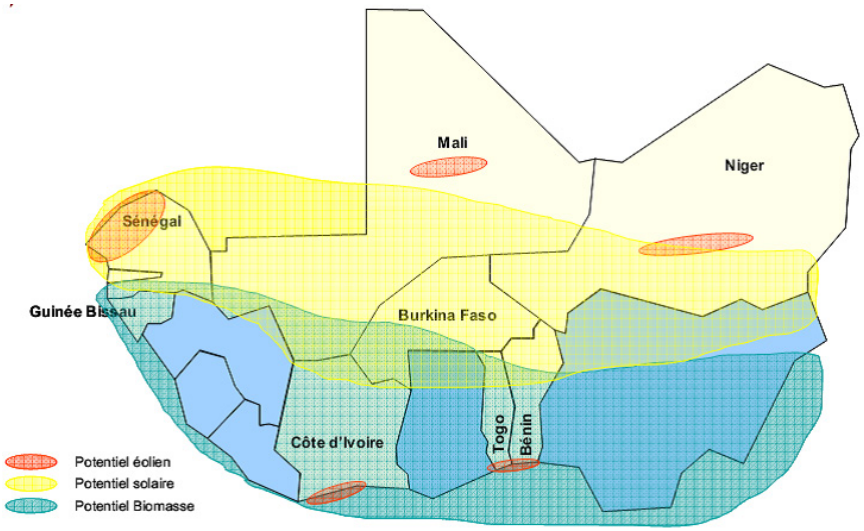
Potential for wind power generation is generally best along the coasts of ECOWAS Member States, particularly in Cabo Verde, which the African Development Bank (AfDB) highlighted as having the best wind potential in West Africa. Mean wind speed at 50m averages above 6 m/s in northern Mali and much of Niger. Potential is also favourable along the coasts of Senegal, the Gambia, Ghana, and Togo[15] (figures 17 and 18).

Figure 17 *Mean wind speeds at 50m asl*



(source: https://irena.masdar.ac.ae/gallery/#map/3454)

Figure 18 *Map of renewable energy potentials in the ECOWAS Region*



(Source: http://www.euei-pdf.org/sites/default/files/field_publication_file/ecowas_baseline_report_en.pdf)

15 Ecowas Renewable Energy and Energy Efficiency status report, 2014

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1.6 Renewable Energy Exploitation

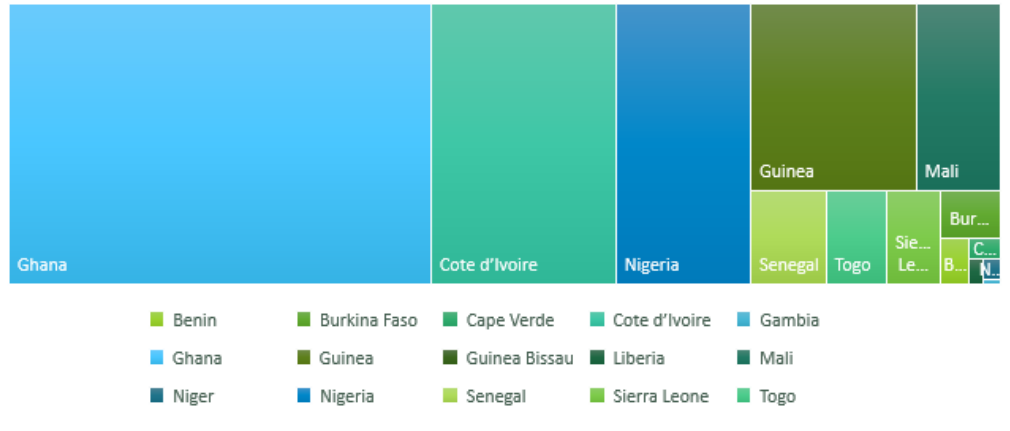
Renewable Energy accounts to approximately **24%** (4,890 out of 20,723 MW) in terms of installed capacity in the region, and **28%** (3,089 out of 10,906 MW) in terms of the operational capacity, as it is derived from the information provided in Table 2 an shown how it is distributed between countries in Figure 19.

Of the currently installed Renewable Energy capacity, approximately 98% comes from Hydro-electric energy, out of which 4% corresponds to small hydro projects of less than 30 MW. The remaining 94% concerns large hydro projects located mainly in Nigeria, Cote d'Ivoire, Ghana and Mali.

The remaining 2% of the renewable installed capacity is produced through solar photovoltaic and wind energy projects.

The theoretical Small Hydro potential of the region, which is estimated to more than 4 GW, is only by approximately 4% exploited, allowing for substantial additions in the SH installed capacity.

Figure 19 *Distribution of current renewable energy operational capacity (3 GW) by country*



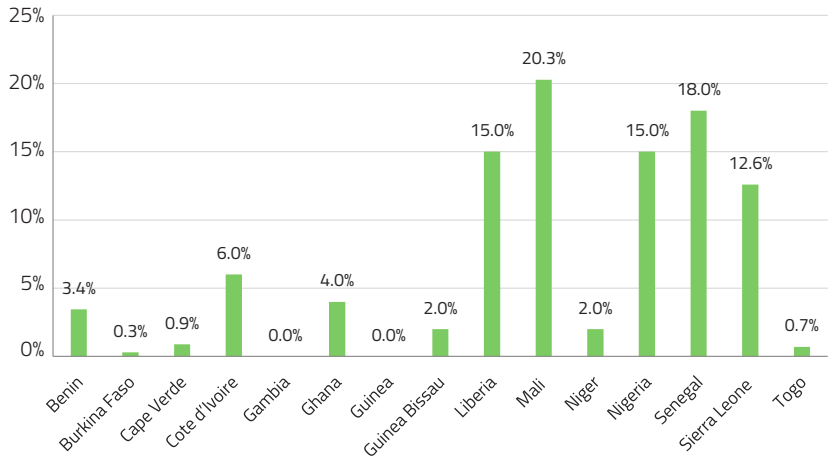
Source: Based on data presented in Table 2

1.7 Access to Efficient and Clean Cooking

According to the information available through the Action Agendas and the NREAPs, the current population using efficient cookstoves or alternative cooking fuels amounts to approximately 75 million people, out of which approximately 40 million use efficient cookstoves and approximately 35 million alternative cooking fuels, namely LPG, biogas, solar cookers, ethanol, etc. Figure 20 and Figure 21 display the share of population, which use efficient cookstoves or alternative cooking fuels.

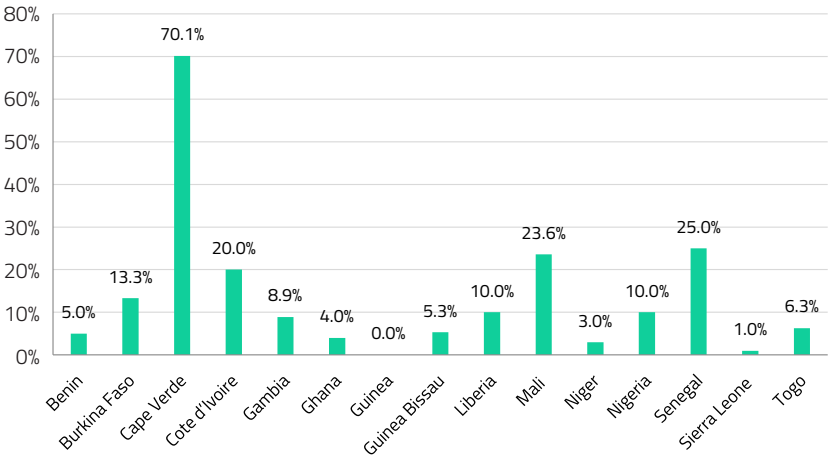
West Africa Clean Cooking Alliance (WACCA) Awareness Raising Campaign

Figure 20 *Current access to efficient cookstoves*



Source: ECOWAS country and AAs and NREAPs

Figure 21 *Current access to alternative cooking solutions*



Source: ECOWAS country and AAs and NREAPs

Countries, such as Gambia or Mali have reported that approximately 40% of the people use efficient cooking methods (efficient cookstoves or alternative fuels), whereas for most of the countries this percentage lies between 5 and 20%, with the exception of Cabo Verde, where efficient/alternative cooking applies to approximately 70% of the population, mainly due to the use of LPG.

The overall share of people using efficient cooking (through efficient cookstoves or alternative/modern cooking fuels) is displayed in Figure 22.

The correlation between GNI per capita and share of efficient cooking is displayed in Figure 23 below, indicating that the higher the GNI of a country, the more efficient cooking methods are used by households.

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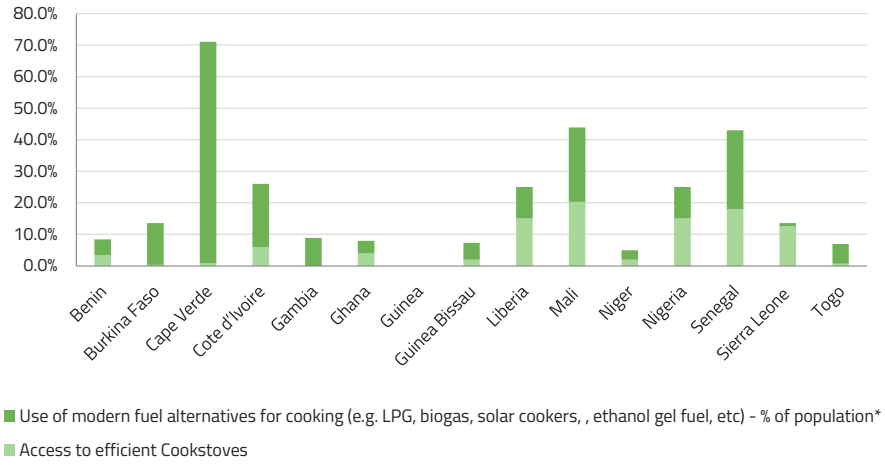
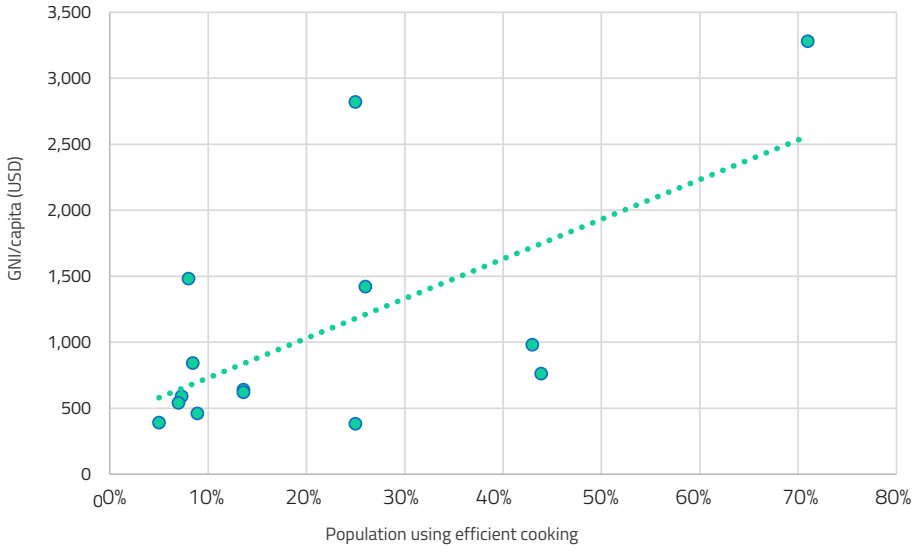
Figure 22 *Current access to alternative cooking fuels (including efficient cookstoves)*



Source: ECOWAS country and AAs and NREAPs

Figure 23 *Relation between GNI per capita and use of efficient cooking*



Source: Own elaboration based on data presented above

Note: For some Countries (namely Burkina Faso, Cabo Verde, Mali, Senegal, Togo) reported access to efficient cookstoves includes access to alternative fuels such as LPG, biofuels etc. In order that consistent information can be provided, this information has been disaggregated. In addition, use of electricity for cooking is not reported in none of the Action Plans, although it is subtly implied.

1.8 Energy Efficiency in the Region

It is well understood that the effort to achieve universal access to energy services has to run hand-by-hand with energy efficiency. Increasing the energy efficiency rates of the different sectors of the economy can potentially tap wasted energy, thus delivering the same amount of energy to more people, at lower costs and at the same time reduce stresses to the economy.

ECOWAS Countries have expressed their commitment to support the energy efficiency policy, which "will complement the existing array of ECOWAS policies by addressing the challenge of making the most efficient use of the region's energy resources".

The ECOWAS Energy Efficiency Action Plan is based on six flagship initiatives, each having as components: policy, capacity building, awareness raising and financing. These initiatives include:

- Efficient Lighting by replacing incandescent lamps with high efficiency lamps.
- High Performance Distribution of Electricity, by reducing technical and commercial losses.
- Access to clean and efficient cooking for the entire ECOWAS population.
- Introduce Energy Efficiency standards.
- Develop and adopt an energy efficiency framework and measures for buildings.
- Mobilise environmental finance instruments

In the Action Plans for Energy Efficiency of all ECOWAS Countries, projections for 2020 and 2030 have been reported, although current energy efficiency conditions are not described in detail either because data is not easily available, or because policies have not been yet implemented or have not yet produced tangible results.

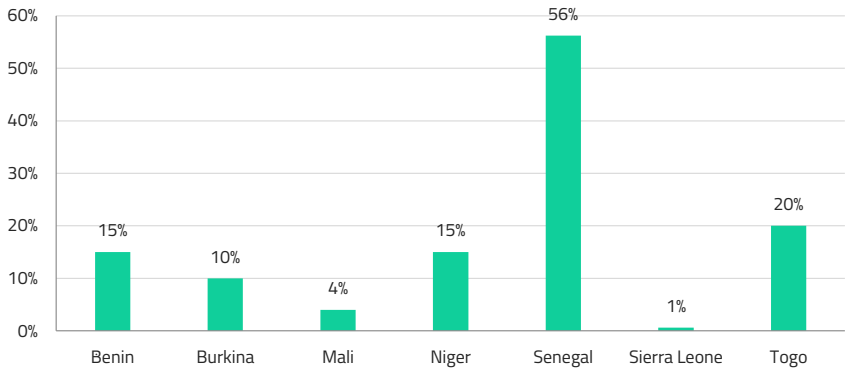
In this section providing current conditions/situation, only some of the indicators are presented, such as the efficient lighting penetration rate and the Transmission/distribution losses. Efficient cooking has been described in the previous paragraph.

1.8.1 Efficient Lighting

Efficient lighting is an "easy" measure with immediate and tangible result. Nevertheless, by expressing the rate of penetration of efficient lighting in terms of population, for the countries for which data have been reported (Figure 24) and for a total population of approximately 110 million, it turns out that an equivalent of 24 million people are served by efficient lights, which corresponds to a penetration rate of 22%.

Figure 24 *Current share of efficient lighting*

Five countries have reported the achieved energy (electricity) savings



Source: AAs and NEEAPs

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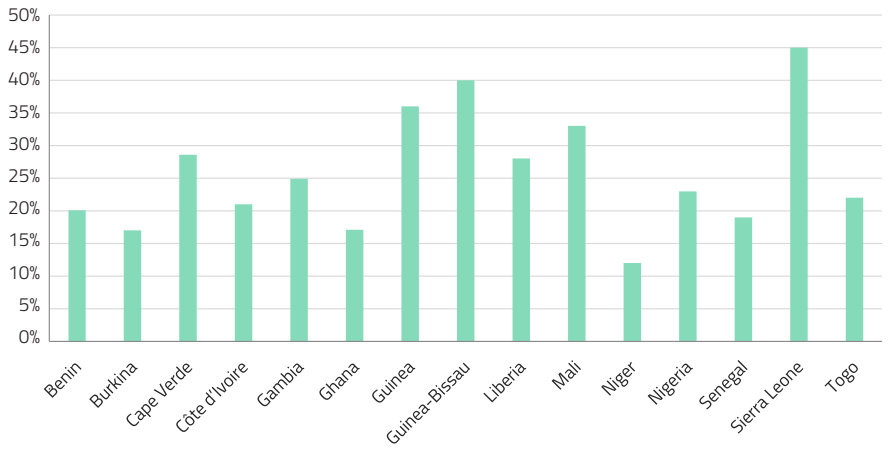
from efficient lighting; Benin, Cote d'Ivoire, Mali, Senegal and Sierra Leone. The estimated electricity savings in these countries due to efficient lighting amount to 424 GWh, meaning an equivalent savings rate of approximately 3% of the on-grid Electricity production, which is approximately 15,000 GWh.

1.8.2 Transmission and Distribution of Electricity

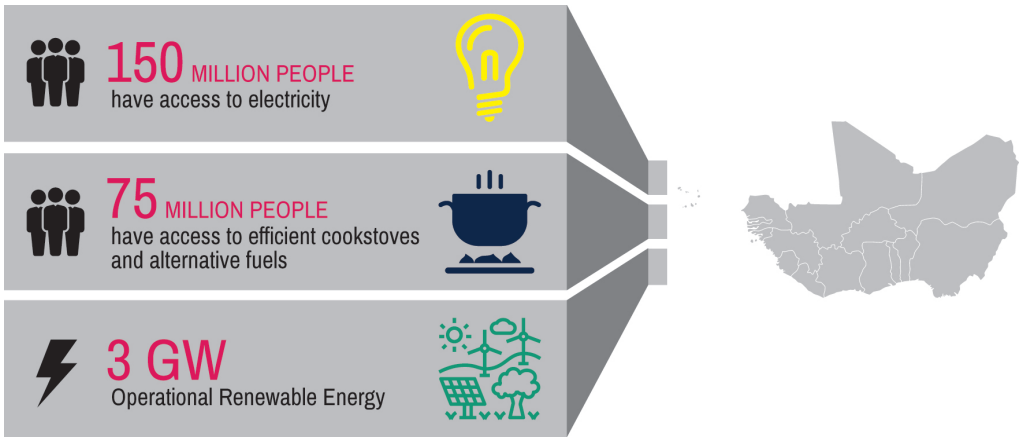
In many West African countries, utilities face important challenges in providing quality energy services, or expanding coverage to new users. One of the causes of this situation are the high transmission and distribution (T&D) system losses[16]. Currently, losses in power distribution in ECOWAS Countries - both through inefficient equipment as well as unpaid consumption - vary from 12% to as much as 45% of the power generated, as displayed in Figure 25.

> Reducing these losses to under 10% of generation is considered as technically and economically feasible. This would release over 1,400 MW of power for new uses and new users, helping the region achieve universal access to modern energy, improve energy security, as well as accelerate economic growth and social progress. It would reduce annual GHG emissions by 2 Mt CO2 eq.
>
> *ECOWAS Energy Efficiency Policy (EEEP) document*

Figure 25 *Current transmission and distribution losses (AAs and NEEAPs)*



Current Access to Electricity, Access to Clean Cooking, Installed Renewable Energy



16 ECOWAS Energy Efficiency Policy, 2013

2. REGIONAL TARGETS

2.1 Energy Access Targets

In the ECOWAS Renewable Energy Policy (EREP), which was adopted by the ECOWAS Ministers of Energy at the ECOWAS High Level Energy Forum, having taken place from 29 to 31 October 2012 in Accra, Ghana., a clear vision was expressed.

To secure an increasing and comprehensive share of the Member States' energy supplies and services from timely, reliable, sufficient, cost-effective uses of renewable energy sources enabling:

- Universal access to electricity by 2030.
- A more sustainable and safe provision of domestic energy services for cooking thus achieving the objectives of the White Paper for access to modern energy services by 2020.

The above have given direction to local Access to Energy policies, to which all countries have been engaged, through actions and policies, aiming to improve the wellbeing of West African populations.

EREP Best-Case Scenario by 2030

As a result of the development of regional and national conducive institutional and regulatory frameworks during 2013-2014, a flourishing market for renewable energy technologies will grow. This enables a comprehensive integration of new renewable energy sources into national energy systems and the regional electricity balance as well as considerable job and business creation. The success is a result of a solid commitment to EREP approach at the highest level by all ECOWAS Member States, under the competent monitoring of ECREEE and its partners.

Universal access for all ECOWAS citizens becomes a reality in 2030, and 75% of the population at that time is grid connected. Renewable energy reaches a share of about 48% of the overall installed electricity capacity in the ECOWAS Region (incl. medium and large hydro) in 2030. The remaining 25% of the ECOWAS population living in smaller localities in remote rural areas will enjoy electricity services from Mini-Grids or will be supplied by highly reliable stand-alone systems. Mini-Grids will provide high quality services at competitive prices.

ECOWAS-GFSE-GEF-UNIDO High Level Forum

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2.2 Renewable Energy Targets

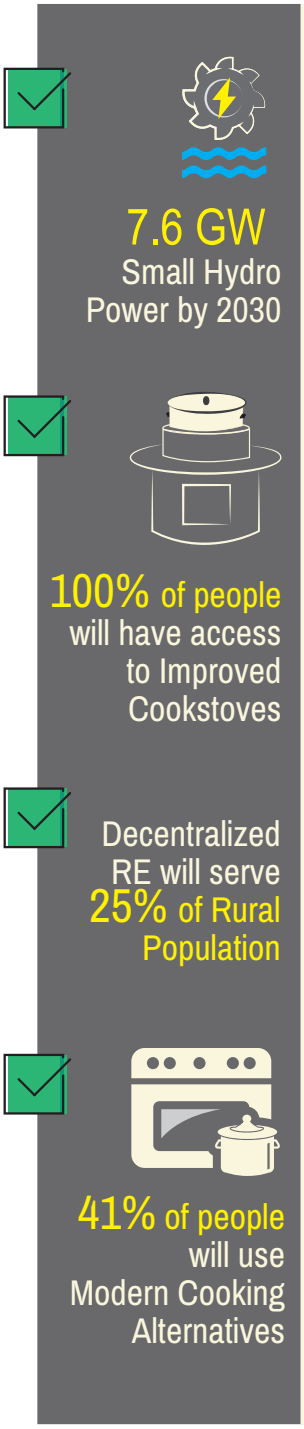
The ECOWAS Renewable Energy Policy (EREP) was adopted by the 43rd Ordinary Session of the ECOWAS Authority of Heads of State and Government, which held in Abuja, Nigeria, from 17 to 18 July 2013. Prior to this, in 2006, the ECOWAS/UEMOA White Paper on access to energy services for populations in rural and peri-urban areas recommended that at least 20% of new investments in electricity generation should originate from locally available renewable resources, to achieve self-sufficiency, reduced vulnerability and sustainable environmental development[17].

The adoption of renewable energy sources in the Region has been expressed by ECOWAS Members through Energy Development Strategies, Energy Policies, Legislation, Action Plans, whose renewable energy is a major constituent. Following the initiation of the SE4ALL initiative, local policies and action plans are being reassessed and commonly re-organized. This allows the assessment as to whether local targets, local actions, and achieved results comply with the Regional targets.

ECOWAS Renewable Energy Policy (EREP) - Regional targets for connected renewable energy

	2010	2020	2030
EREP Targets in MW	0	2,425	7,606
EREP Targets in % of peak load	0%	10%	19%
EREP Power Generation Targets in GWh	0	8,350	29,229
EREP Targets in % of energy demand	0%	5%	12%
Total renewable energy penetration (incl. Medium and Large Hydro MLH)	**26%**	**23%**	**31%**

17 ECOWAS Renewable Energy Policy (EREP), http://www.ecreee.org



From the declaration of **ECOWAS Renewable Energy Policy (EREP)***

ARTICLE 2

The Member States and ECOWAS shall implement the Regional Renewable Energy Policy with the objective of contributing to the achievement of universal access to sustainable energy services in the ECOWAS Region by 2030.

The specific targets of the regional policy are:

1. For grid-connected renewable energy:
   - Increase the share of renewable energy in the overall electricity mix, including large hydro, to 35% by 2020 and 48% by 2030;
   - Increase the share of renewable energy in the overall energy mix, excluding large hydro, to 10% by 2020 and 19% by 2030. This will lead to the installation of 2,424 MW renewable energy generation capacity from wind, solar, bioenergy and small scale hydro power by 2020 and to 7,606 MW by 2030.
2. For decentralized renewable energy solutions:
   - Increase the share of the rural population served by decentralized renewable electricity services (e.g. Mini-Grids and stand alone systems) to 22% by 2020 and 25% by 2030.
3. For domestic applications:
   - Ensure universal access to improved cook-stoves to 100% by 2020;
   - Increase the share of the population served with modern fuel alternatives including LPG, for cooking to 36% by 2020 and 41% by 2030;
   - Increase the share of efficient charcoal production to 60% by 2020 and 100% by 2030;
   - Increase the share of Solar Water Heating (SWH) technologies for sanitary hot water and preheating for commercial and industrial processes as prescribed in the attached policy document;
   - Introduce blending ration for Ethanol/bio-diesel in transport fuels of 5% by 2020 and 10% by 2030;
   - Conduct research on the use of ethanol and other fuels as domestic cooking fuels;
   - Prepare a separate regional policy for sustainable use of bio-energy, including bio-fuels and waste to power to be adopted by the ECOWAS Ministers in charge of energy;
   - Create instruments for financing sustainable energy including carbon finance, by the end of 2013, and in the longer term, establish a regional fund for the development and implementation of sustainable energy projects;
4. For regional manufacture of renewable energy equipment:
   - Ensure that 7% of the Renewable Energy equipment, by value, installed in 2020 is regionally manufactured. This proportion should reach 20% by 2030.

*Source: http://www.ecreee.org/sites/default/files/documents/ecowas_renewable_energy_policy.pdf

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2.3 Consolidated Targets

This section of the document presents the regional consolidated targets- as expressed and reported in their SE4ALL Action Plans and Action agendas.

2.3.1 Access to Electricity

Access to Electricity for all countries is planned to happen through the expansion of the Electricity grids, new on-grid Electricity Capacity, Mini-Grids, or autonomous Electricity systems.

Each country's vision for access to energy up to 2030, is expressed in the relevant Action Plans, which have been prepared in the framework of the SE4ALL initiative (Figure 26).

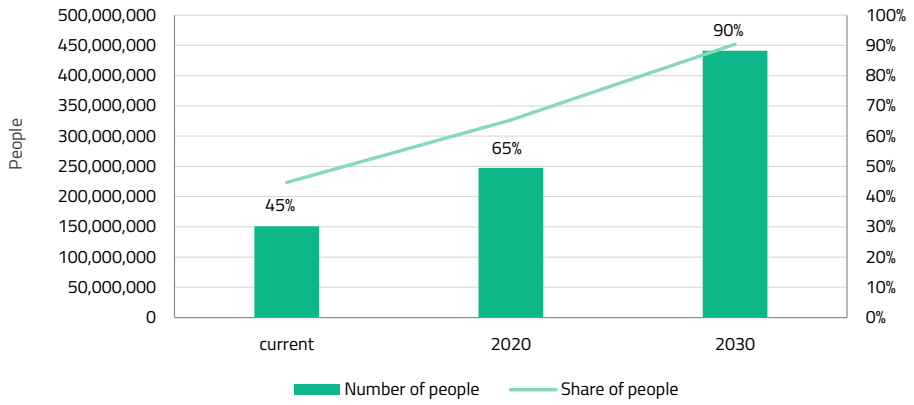
The access rate to electricity services is expected to double from its current rate. A notable issue is that countries, which currently demonstrate quite low access to electricity, have expressed quite ambitious targets, which should be supported by substantial efforts, to prove that they are realistic. Such countries include Liberia with a current access rate of 1.4% and 100% target by 2030, Sierra Leone moving from its Current 12% to 92% or Benin from its current 32% to 100%.

Figure 26 *Access to electricity trajectories for the ECOWAS Countries*

Source: National AAs

Overall, from the current electricity access rate in the region (according to the information contained in each country's Action Agenda), which is approximately 45% (65% in urban areas and 25% in rural areas), the electricity access rate is expected to reach approximately 90% by 2030. Taking into consideration the increase of the population to almost half a billion by that year, it is expected that more than 250 million people will gain access to electricity services. Figure 27 displays the expected evolution of the Electricity access rate, as well as the approximate number of people which will be served by electricity by 2020 and 2030.

Figure 27 *Access to electricity trajectory in the ECOWAS Region*

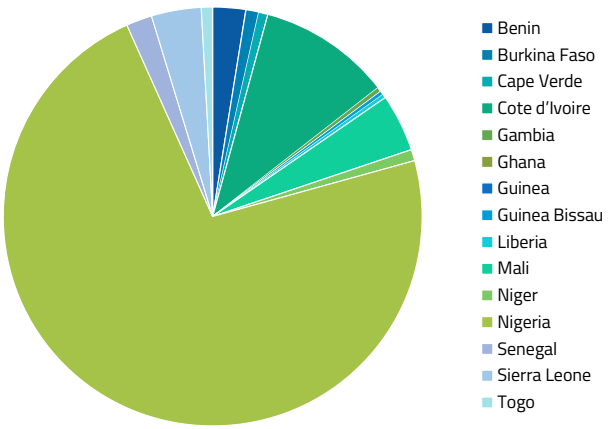


Source: National AAs

2.3.2 Grid Connected RE

Currently, grid connected Renewable Energy amounts to approximately 4.9 GW in terms of installed capacity and approximately 3 GW in terms of operational capacity. The share of each country's installed RE is displayed in Figure 28. The overall RE installed capacity is expected to reach 14.5 GW in 2020 and more than 30 GW in 2030, with most of this capacity to be generated in Nigeria.

Figure 28 *Renewable energy installed capacity by country, including large and medium scale hydro*



In addition, although current medium and large hydro capacity accounts for more than 94%, in 2030 the energy supplied from RE is planned to be attributed in a more balanced way to Small Hydro, Large Hydro, solar photovoltaic and biomass, as shown in Figure 29 and Figure 30.

It should be noted that the overall RE planned capacity from Small Hydro (1.8 by 2020 and 8.8 GW by 2030), Biomass (0.9 by 2020 and 3.9 GW by 2030), Solar (2.4 by 2020 and 8.9 GW by 2030) and wind (0.25 by 2020 and 0.5 GW by 2030) over-exceeds by almost three times the ECOWAS target of 7.4GW by 2030, whereas the small hydro planned capacity is close to the estimated potential of the region (9.5 GW), as provided by the "Prospects for the African Power Sector" report published in 2012 by IRENA[18]. The target for RE capacity in 2020 is 14 GW and 31.5 GW in 2030 (5.4 and 22 GW for 2020 and 2030 respectively without medium-large Hydro).

18 https://www.irena.org/DocumentDownloads/Publications/Prospects_for_the_African_PowerSector.pdf

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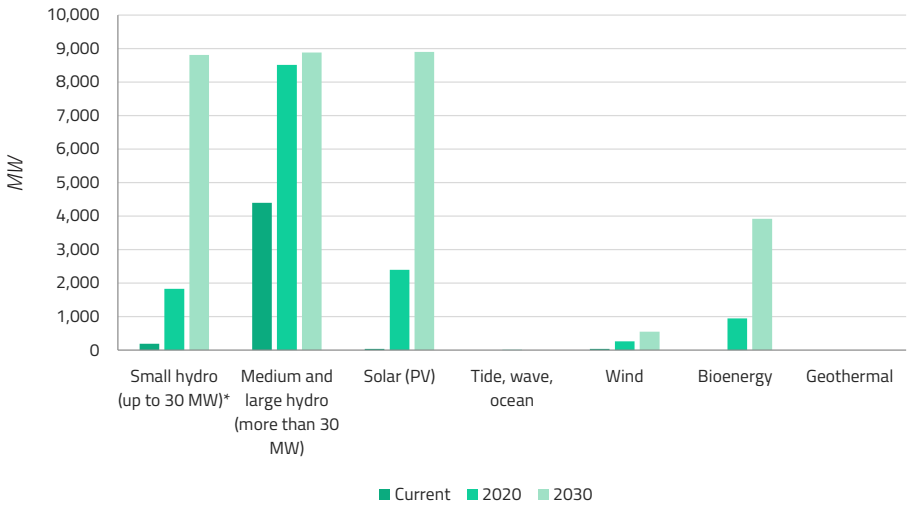
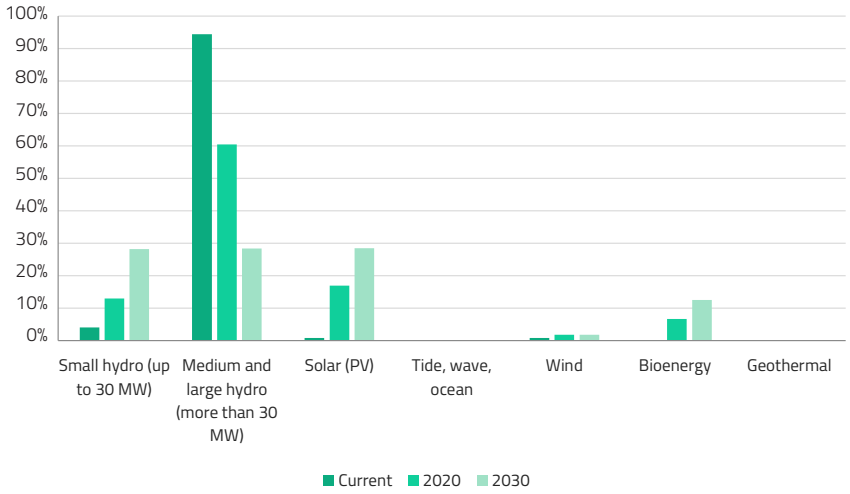
2.3.3 RE Targets per Technology

Figure 29 *Grid connected renewable energy installed capacity (per renewable energy technology)*



Source: National AAs

Figure 30 *Share of grid connected renewable energy installed capacity (per renewable energy technology)*

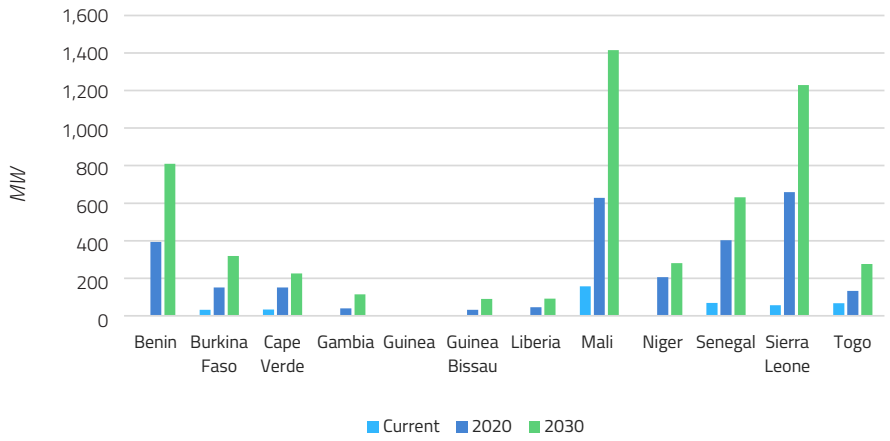


Source: National AAs

Figure 31 through Figure 34 display the country trajectories for RE installed capacity including or excluding Large Hydro capacity. They are presented in two sets of countries:

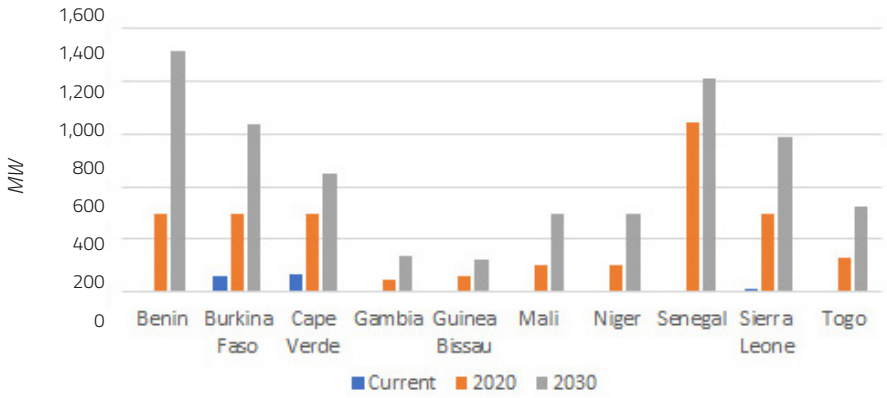
- Countries with total RE installed capacity of less than 1,500 MW by 2030 and,
- Countries with more than 1,500 MW (Cote d'Ivoire, Ghana and Nigeria).

Figure 31 *Grid connected renewable energy installed capacity in MW (per country, including large hydro)*



Source: National AAs

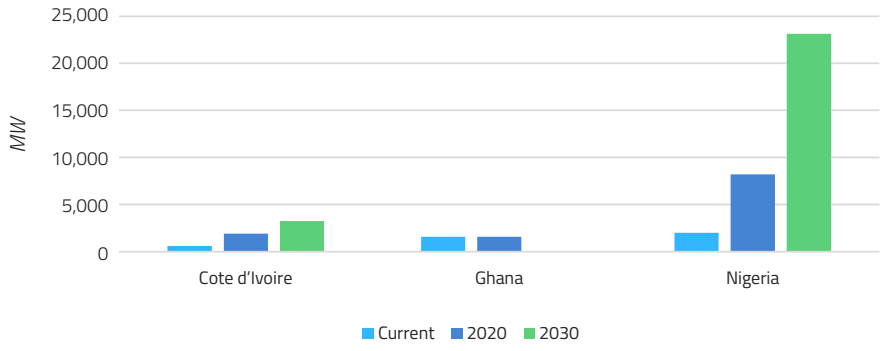
Figure 32 *Grid connected renewable energy installed capacity in MW (per country, excluding large hydro)*



Note: Guinea's AA is not available

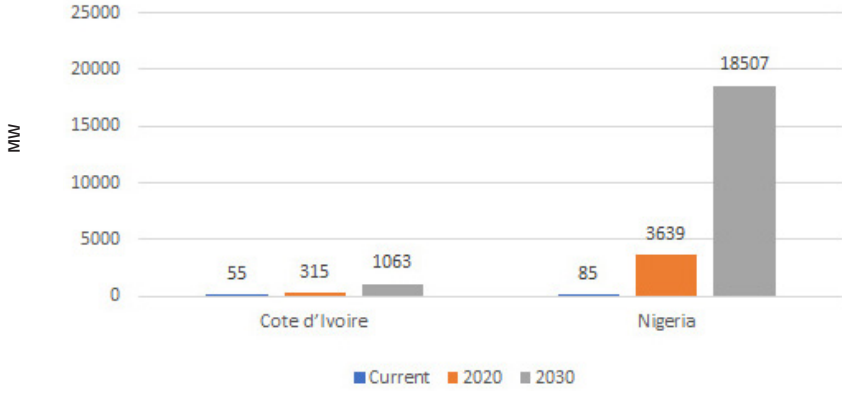
Source: National AAs

Figure 33 *Grid connected renewable energy installed capacity in MW (per country, including large hydro)*



Source: National AAs

Figure 34 *Grid connected renewable energy installed capacity in MW (per country, excluding large hydro)*

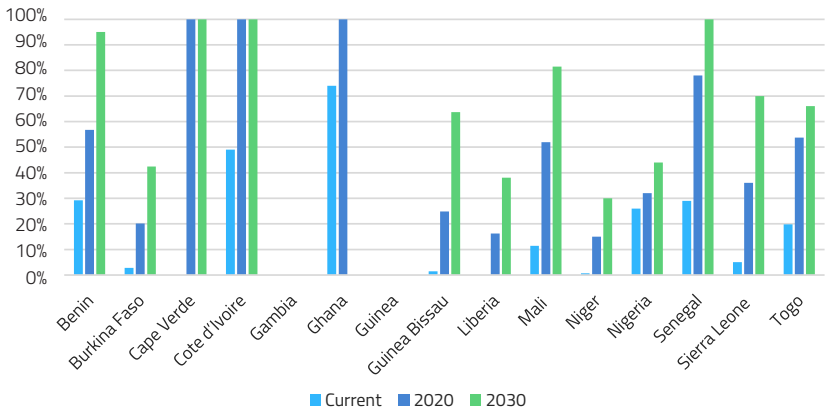


Source: National AAs

2.3.4 Rural Electricity

Of the current rural population of around 185 million in the region, a percentage of around 25%, or 50 million people, have access to electricity services, with varying shares between the ECOWAS Countries. The highest share of electrified rural population appears to be in Ghana (Cabo Verde has not reported relevant information), whereas the lower shares appear to be in Burkina Faso, Guinea Bissau, Liberia, the Niger and Sierra Leone, where electrification of rural population stands at 5% or lower percentages (Figure 35).

Figure 35 *Rural population served by electricity services (% of rural population)*



Source: National AAs

By 2020, Ghana and Cote d'Ivoire project a rate of rural electrification of 100% (more than 40% in the Region) and by 2030 approximately 60% of rural population is expected to have access to electricity.

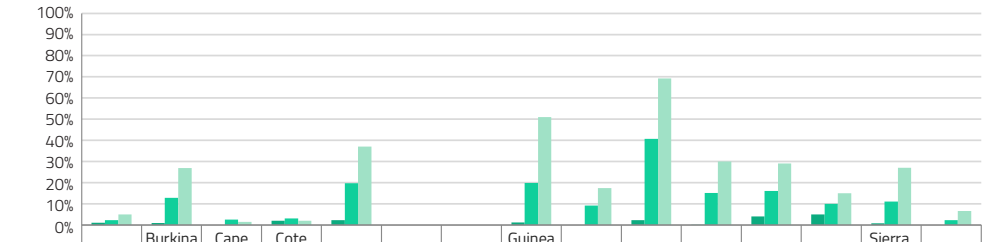
2.3.5 Off-grid Renewable Energy Applications (Mini-Grid and Standalone systems)

Current share of population in the Region served by decentralized energy services is recorded to be less than 3%, which is equivalent to approximately 5 million inhabitants[19].

Up to 2030 approximately 60 million people are expected to gain access to electricity coming from Mini-Grids or standalone systems, based on Renewable Energy Sources, mainly Hydro and Solar (PV).

19 Numbers do not include Cabo Verde, Gambia, Ghana, Guinea and Togo for which information has not been reported in the Action Agendas

Figure 36 *Rural population served by decentralized renewable energy services (mini-grid/stand-alone)*



	Benin	Burkina Faso	Cape Verde	Cote d'Ivoire	Gambia	Ghana	Guinea	Guinea Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Current	1%	0.9%	0%	2%	2.3%	0%	0%	1.2%	0%	2.23%	0.12%	4%	5%	0.75%	0%
2020	2.3%	12.8%	2.5%	3%	19.7%	0%	0%	19.8%	9.8%	40.65%	15.1%	16%	10%	11%	2.22%
2030	5%	26.9%	1.5%	2%	37%	0%	0%	50.9%	17.4%	69.24%	30%	29%	15%	27%	6.59%

Note: Guinea's AA is not available

Source: National AAs

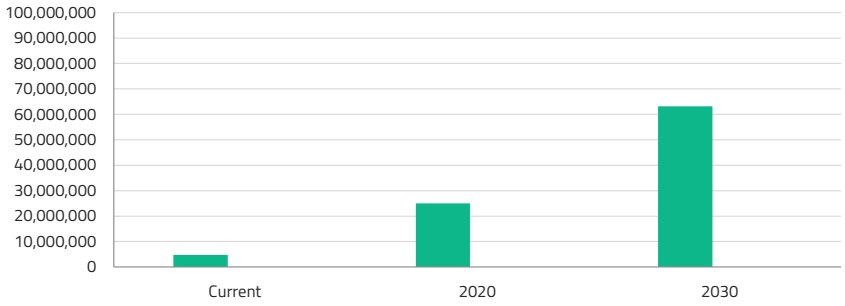
Figure 37 *Rural population served by decentralized renewable energy services (mini-grid/stand-alone)*

	Benin	Burkina Faso	Cape Verde	Cote d'Ivoire	Gambia	Ghana	Guinea	Guinea Bissau	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Current	49.5	116.8	0.0	225.3	0.0	0.0	0.0	10.5	0.0	290.2	14.5	3,669.2	370.3	28.3	0.0
2020	156.3	1997.7	5.6	316.6	158.7	0.0	0.0	334.4	170.9	4,398.5	2,721.3	13,347	869.8	487.4	98.7
2030	307.5	3791.0	11.0	413.7	350.8	0.0	0.0	764.1	572.5	14,758	3,630	34,960	1,705.3	1,526.7	377.2

Note: Guinea's AA is not available

Source: National AAs

Figure 38 *Rural population served by decentralized renewable energy services (mini-grid/stand-alone)*



Source: National AAs

To achieve these rates of electrification in the region, use of Renewable Energy, is expected to play a crucial role. Table 5 displays the RE capacity in MW per country for off-Grid systems based on Renewable Energy, for the countries which have reported this index.

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Table 5 *Total off-grid installed renewable energy (MW)*

	Total off-grid installed Renewable Energy (MW)		
	Current	2020	2030
Benin	0,0	6,7	13,5
Burkina	0,3	3,6	10,0
Cabo Verde	n.a.	n.a.	n.a.
Côte d'Ivoire	0,0	5,4	n.a.
Gambia	n.a.	n.a.	n.a.
Ghana	1,140.0	1,250.0	1,360.0
Guinea	n.a.	n.a.	n.a.
Guinea-Bissau	n.a.	n.a.	n.a.
Liberia	4.6	31.0	57.4
Mali	16.4	173.6	469.7
Niger	4.0	34.0	100.0
Nigeria	0.3	18.5	904.0
Senegal	2.0	10.5	14.0
Sierra Leone	0.3	86.0	178.0
Togo	0.0	3.0	8.0
	1,168	**1,622**	**3,115**

The capacity reported above concerns either Mini-Grids served only by Renewable Energy, or Mini-Grids (RE and hybrid), or Rural PV and Pico-Hydro systems, as presented in Table 6 below.

Table 6 *RE installed capacity in Mini-Grids, pure and hybrid, or pico hydro systems*

	Minigrids served only by Renewable Energy (MW)			Mini-Grids RE and hybrid (MW)			Rural PV and Pico-Hydro systems (MW)		
	Current	2020	2030	Current	2020	2030	Current	2020	2030
Benin	0.0	4.5	9.5	0.0	0.0	0.0	0.0	2.0	4.0
Burkina	0.1	1.8	5.0	0.0	0.0	0.0	0.3	1.8	5.0
Cabo Verde	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Côte d'Ivoire	n.a.	n.a.	n.a.	n.a.	5,4	0,0	n.a.	n.a.	n.a.
Gambia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Ghana	n.a.	n.a.	n.a.	40	50	60	1,100	1,200	1,300
Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Guinea-Bissau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Liberia	4.6	4.6	4.6	n.a.	n.a.	n.a.	n.a.	26.4	52.8
Mali	0.6	118.3	355	2.9	8.1	8.1	12.9	47.2	106.6
Niger	n.a.	n.a.	n.a.	0.0	15	40.0	4.0	19.0	60.0
Nigeria	0.0	11	673	0.0	4.0	171	0.3	3.5	60.0
Senegal	0.6	7.6	10.1	0.0	0.0	0.0	1,4	2,9	3,9
Sierra Leone	n.a.	n.a.	n.a.	0.3	70.0	134.0	0.0	16.0	44.0
Togo	n.a.	n.a.	n.a.	0.0	1.5	4.0	0.0	1.5	4.0
	5.8	**147.8**	1,057	**43.2**	**154**	**417**	**1,119**	**1,320**	**1,640**

Mini-Grid (MG) is one of the three main approaches, the other two are solar-home systems (SHS), and grid extension to achieving the goal of universal electricity access goal. Clean Energy Mini Grids (CEMGs) have proven to be more cost effective and quicker in implementation as opposed to grid extension for remote rural locations, and low-density areas.

Senegal and Mali leads the region in promoting CEMGs with at least 100 operational systems, with the rest countries lagging behind. Although progress is being made, the implementation pace is still slow with less than 300 operational CEMGs in the region with very few countries being at the forefront. Achieving significant results will involve all stakeholders, (government, private sectors, development partners, financial institutions), technologies, business models etc.[20]

To a large extent rural electrification will be served by Mini-Grids or micro systems which, will be potentially integrated to the electricity networks of the countries as these will expand.

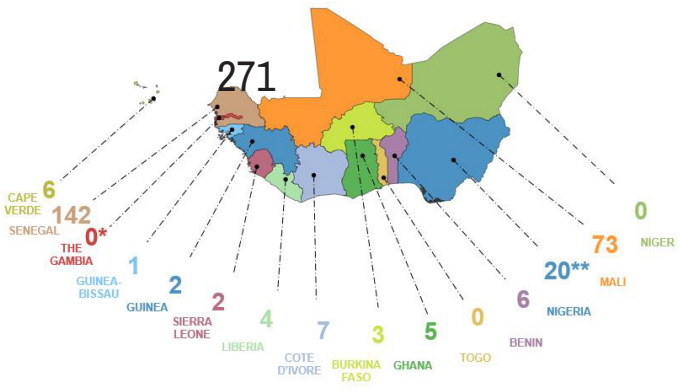
Of the countries which have reported their targets for the number of Mini-Grids up to 2030, Cote d' Ivoire is expected to have 94 MGs by 2020, whereas 0 (zero) by 2030, presumably because these will have integrated into the main grid, whereas in Senegal the State has planned universal access by year 2025. Table 7 displays the Mini-Grids expected to be implemented in 8 out of the 15 ECOWAS Countries. Compared with the ECOWAS target of 68,000 Mini-Grids, the target coming from the aggregation of the information in the Action Plans is certainly small, not including the small localities of 500 or even 1,000 inhabitants which can be served by small systems.

> The market for Mini-Grids and decentralized supply systems will typically address the need of rural populations living in rural centres and villages with population comprised between 200 and 2,500 inhabitants. Some larger cities can be included in this market segment according to their peripheral geographical situation vis-a-vis the national grid. This market will supply 71.4 million inhabitants living in 60,000 localities by 2020 and 104 million living in 96,000 localities by 2030. Some of the off-grid localities supplied before 2020 (estimated to 32,000) might be included in the grid extension as they will have grown up and their EREP renewable energy options connected to the grid. Therefore, the number of mini grids to be established after 2020 is of 68,000*.

Table 7 *Installed off-grid capacity in the ECOWAS Countries*

	Total off-grid installed renewable energy (MW)		
	Current	2020	2030
Benin			
Burkina			
Cabo Verde			
Côte d'Ivoire	n.a.	94	0
Gambia			
Ghana		50	
Guinea			
Guinea-Bissau	0	6	15
Liberia	0	23	30
Mali	2	189	250
Niger			
Nigeria			
Senegal	27	783	783
Sierra Leone	2	25	65
Togo	0	5	15
		1,175	1,158

Number of Clean Energy Mini-Grids (CMG)



Source: Mapping & assessment of existing clean mini-grid experiences in West Africa, ECREEE, Dec 2016

20 Mapping & assessment of existing clean mini-grid experiences in West Africa, ECREEE, Dec 2016

* Baseline Report for the ECOWAS Renewable Energy Policy (EREP)

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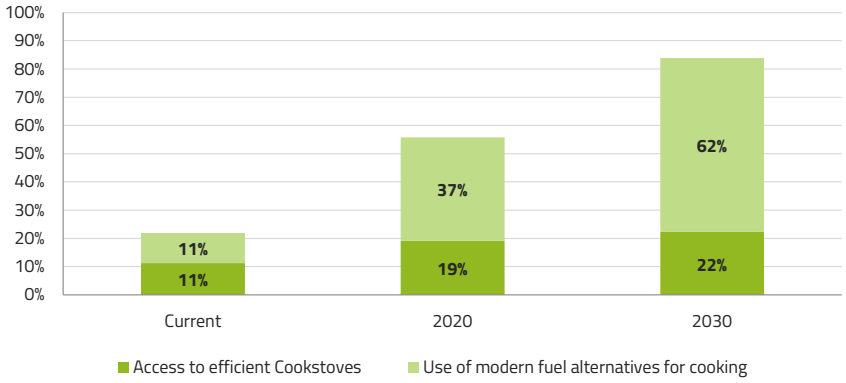
2.3.6 Efficient Cookstoves and Cookstoves using Alternative Fuels

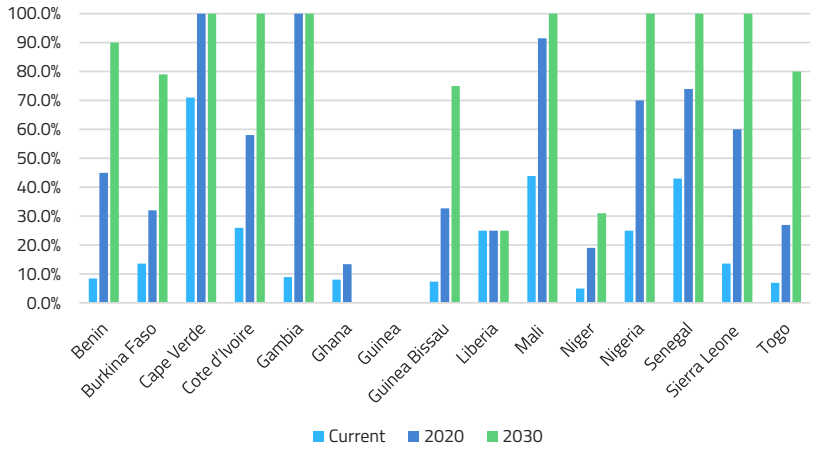
Out of the population today (estimated at 340 million), approximately 22% (of the total population) use efficient cookstoves and of those approximately half have access to modern and efficient fuel alternatives. This situation is expected to change considerably by 2030, when more than 80% of the total population (Figure 39) is expected to use either efficient cookstoves or modern alternative fuels for cooking, implying that more than 400 million people will be using modern/efficient cooking options. Modern fuels are expected to reach more than 60% in the region, replacing traditional cookstoves, even at their efficient version.

Figure 39 *Share of population using efficient cooking*



Source: AA/NREAP/NEEAP

Figure 40 *Targets for efficient cooking (% of population)*

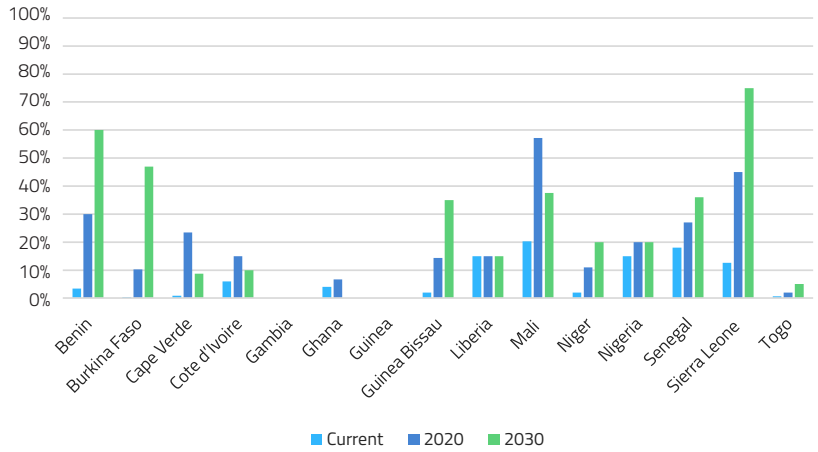


Source: AA/NREAP/NEEAP

The percentage of the population using efficient cookstoves and modern fuels for cooking are presented in Figure 41 and Figure 42. By 2030 more than 100 million people are expected to be using efficient cookstoves, and approximately 300 million people are expected to be using modern fuel alternatives or cooking methods.

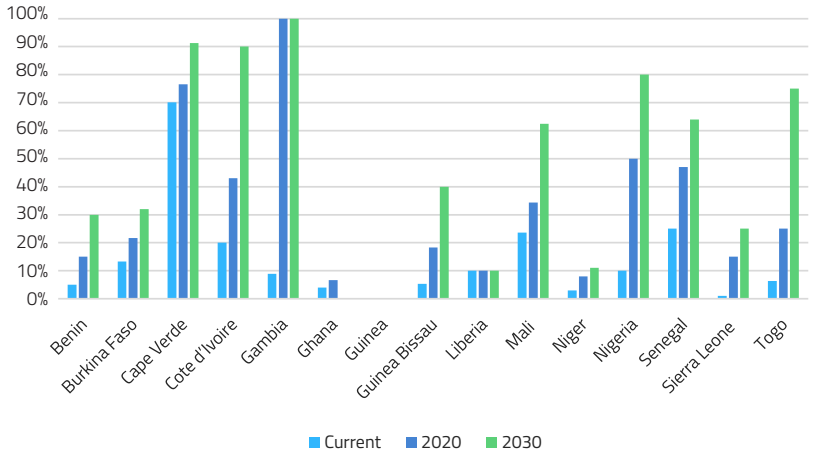

Source: http://cleancookstoves.org/
http://www.lowtechmagazine.com/2014/06/thermal-efficiency-cooking-stoves.html

Figure 41 *Targets for efficient cookstoves (% of population)*



Source: AA/NREAP/NEEAP

Figure 42 *Targets for alternative fuels (% of population)*



Source: AA/NREAP/NEEAP

2.3.7 Solar Water Heaters

Solar Water heating systems will play a significant role in electricity demand mitigation for domestic, commercial and industrial requirements. The targets proposed through the ECOWAS Renewable Energy policy concern:

- 25% and 50% of the district health centres and the maternity clinics as well as school kitchens, boarding schools and barracks by 2020 and 2030.
- 10% by 2020 and 25% by 2030, for hotels
- For agro-food industries using process hot water applying oil-fired boilers; at least 10% of these industries will apply this technology as pre-heater to their boilers by 2030 and 25% by 2030.
- All new built detached houses costing more than €75,000 are equipped at least with one solar water heater system.

To this end, the targets per country where data have been reported in the Action Plans for Renewable Energy (AREP) are shown in the following paragraphs.

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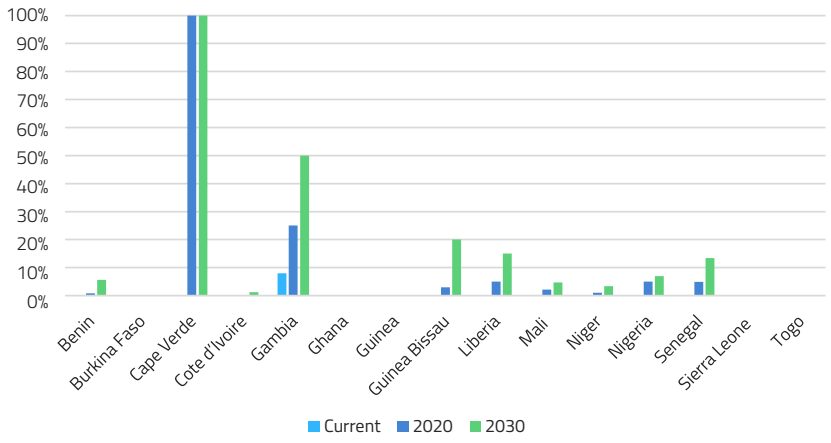
Residential Sector

For most of the countries the share of new buildings (as per above criteria) being equipped with Solar Thermal systems is expected to range between 5% and 20% (Figure 43) with the exception of Gambia having set a target of 50%. Cabo Verde's ambitious target is to reach a rate of 100% even by 2020. A few countries have reported number of buildings, which will incorporate solar thermal systems, such as Benin with 20 buildings in 2020 and 200 in 2030, Côte d'Ivoire with 5,659 buildings in 2020 and 71,939 in 2030, Guinea Bissau with 8 in 2020 and 70 in 2030, Liberia with 17,500 in 2020 and 53,000 in 2030, Mali with 56,000 in 2020 and 206,000 in 2030, the Niger with 31,828 in 2020 and 91,455 in 2030, Senegal with 102,000 in 2020 and 328,000 in 2030, Sierra Leone with 480 in 2020 and 1,880 in 2030 and Togo with 942 in 2020 and 2,985 buildings in 2030. In total for the countries which have given targets, more than 200,000 will have solar systems installed and more than 750,000 in 2030.

Figure 43 *Percentage of buildings with solar thermal systems*



Source: AA/NREAP/NEEAP

Health Centres, Maternities, Schools

This situation changes for Health centres, maternities, schools, where in most countries Hot Water Systems will be applied to percentages ranging 20 and 100% (Figure 44). It is difficult to accurately aggregate this indicator for the whole region as the number of respective institutions per country is not reported in the relevant Action Plan documents. On the other hand, supposing that there is an average number of such institutions, same for all countries, it could be estimated that in the region approximately 10% of these institutions will have solar systems installed by 2020 and approximately 25% in 2030. It should be noted though that the low percentage is attributed to Nigeria, which has reported a very small penetration rate of only 2% in 2020 and 5% in 2030.

Agro-food Industries

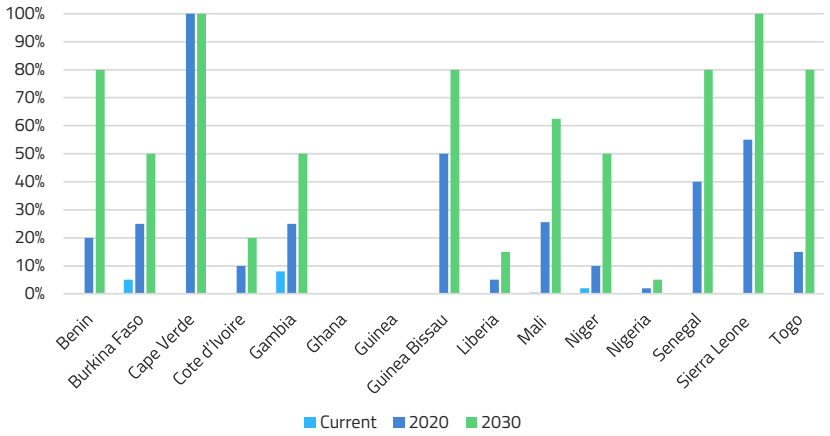
In a similar manner, the share of agro-food industries which are going to use solar systems for preheating of process water is given in Figure 45.

In order to have an estimate of the ("aggregate") regional target, taking into consideration each country's targets, a gross assumption has been made, that the per capita health etc. institutions or agro-food industries is similar for all countries

It seems that the on-aggregate share of Health Centers, schools, etc. lies close to 9.5% for the region in 2020 and 23% in 2030 (excluding Ghana and Gambia which have not reported such info) and the aggregate share of agro-food industries is approximately 9.5% and 19% by 2020 and 2030 respectively. For the health centres, maternities, etc. the target lies far from the 50% regional target, whereas for the

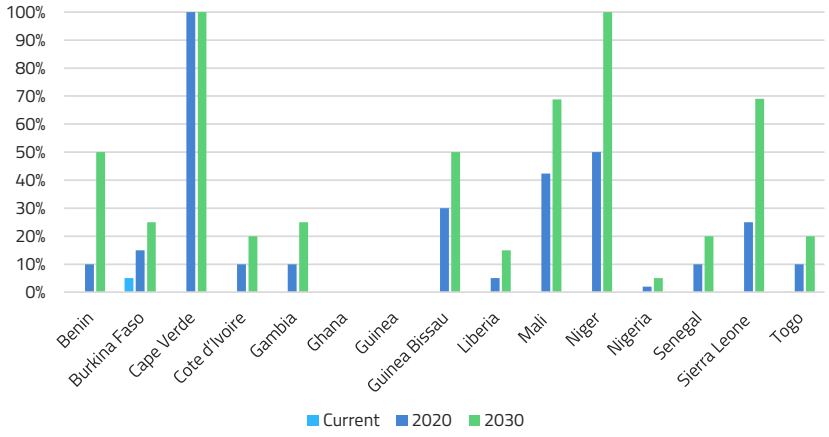
industrial sector the target approximates the regional target. This is partly attributed to the Nigerian low targets, as the population of Nigeria is more than 50% of the population in the region. Taking Nigeria out, the relevant aggregate targets become approximately 45% for Health/Schools and approximately 35% for the agro-food industries.

Figure 44 *Share of district health centres, maternities, school kitchens and boarding schools with solar thermal systems*



Source: AA/NREAP/NEEAP

Figure 45 *Share of agro-food industries with solar thermal systems*



Source: AA/NREAP/NEEAP

2.3.8 Biofuels

Not all countries have reported share of biofuels in the overall gasoline consumption. Of the countries, which have provided such targets, half of these have reported that the relevant share will exceed the targets of 5% and 10% by 2020 and 2030 respectively (Benin, Mali, Sierra Leone), whereas other will introduce ethanol but at lower rates.

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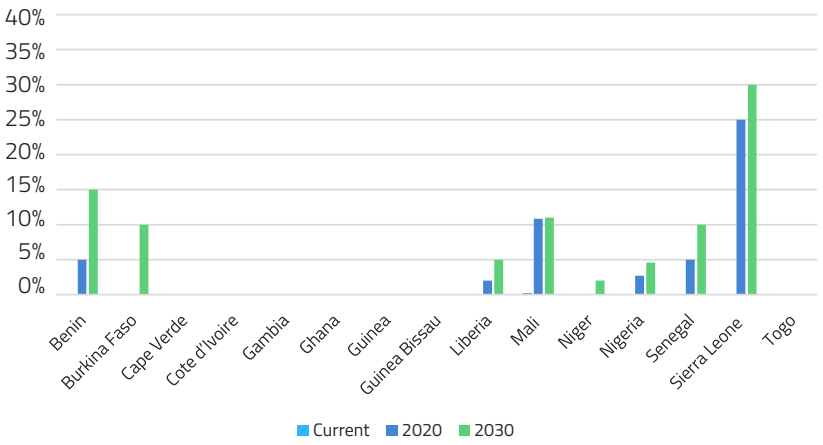
Figure 46 *Ethanol as % of gasoline consumption*



Source: AA/NREAP/NEEAP

2.4 Energy Efficiency Targets

From the declaration **ECOWAS Energy Efficiency Policy (EEEP)***

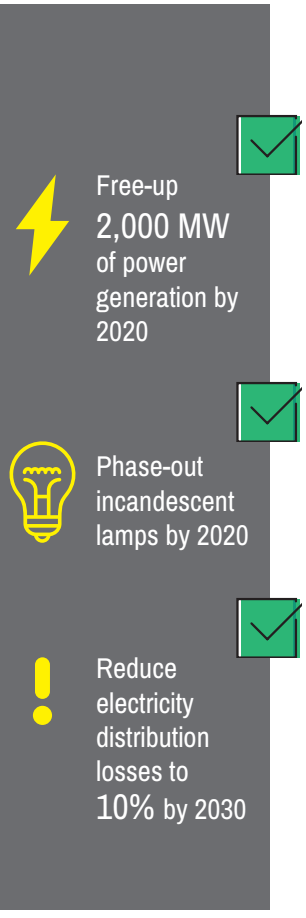
Article 1:

The Energy Efficiency Policy and Action Plan for implementation of the energy efficiency policy are hereby adopted.

Article 2:

1. The overall objective of the Energy Efficiency Policy by 2020 is to improve energy efficiency in the ECOWAS Region to levels of international standards.
2. The specific target of the regional policy is:
   (i) To implement efficiency measures that free-up 2,000 MW of power generation capacity by 2020;
   (ii) Phase out inefficient incandescent lamps by 2020;
   (iii) Reduce average losses in electricity distribution from the current levels of 15-40% to the world standard levels of below 10%, by 2020;
   (iv) Achieve universal access to safe, clean, affordable, efficient and sustainable cooking for the entire population of ECOWAS, by 2030;
   (v) Adopt region-wide standards and labels for major energy equipment by end of 2014;
   (vi) Develop and adopt region-wide efficiency standards for buildings (e.g. building codes);
   (vii) Create instruments for financing sustainable energy, including carbon finance, by the end of 2013 and in the longer term, establish a regional fund for the development and implementation of sustainable energy projects.

*Source:
http://www.ecreee.org/sites/default/files/documents/ecowas_energy_efficiency_policy.pdf



Energy Efficiency Trajectories

Efficient use of Energy has already been recognized by ECOWAS and ECOWAS member states, through the implementation of certain policies, measures and actions aiming to improve local and regional Energy Efficiency Indicators. Energy Efficiency has become an integral constituent of the Energy policy of all countries, aiming to free-up energy capacity, avoid "un-necessary" energy investments, or avoid the negative environmental impact of currently employed practices.

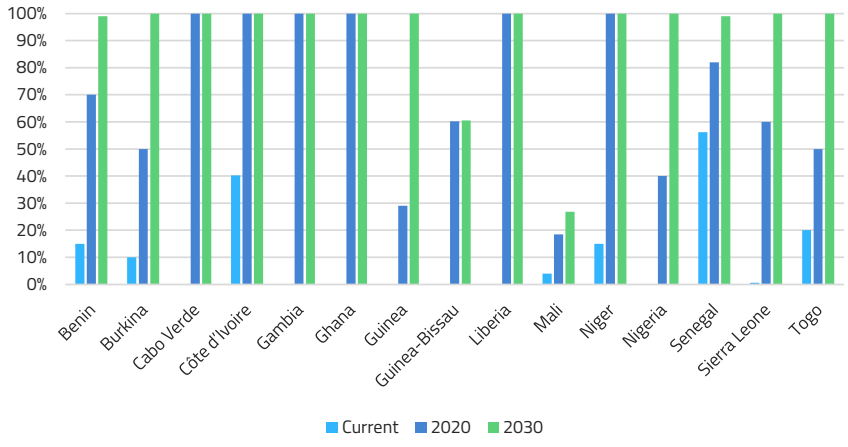
The web of actions towards Energy Efficiency includes legal or institutional, technical interventions, financial measures, capacity building and awareness, among others. Through the National Energy Efficiency Actions Plans, targets have been quantified to the maximum possible extent, thus allowing states and the region to have a clear and defined objective for the near and mid-term future.

The sections below provide information on individual and consolidated targets of the ECOWAS Countries, as these are reported through the individual Energy Efficiency Action Plans.

2.4.1 Energy Efficient Lighting (on-Grid)

Efficient lighting is one of the measures with immediate impact both in terms of freeing up production capacity, but also in terms of reducing the relevant households' expenditure. That is why Efficient lighting is high in the agenda of the Energy Efficiency measures. Even by 2020 almost half of the countries have as their target to eliminate completely incandescent lamps, and by 2030 all countries aim to having achieved penetration efficient lighting at a rate of 100%. Relevant targets for each country are displayed in Figure 47. The energy savings from efficient lighting are given in Annex 3.

Figure 47 *On-grid trajectories of efficient lighting*



Source: AA/NREAP/NEEAP

At Regional Level, and based on the individual targets, more than 95% of lighting will be done with efficient lights by 2030. By 2020, the share of efficient lights in the region is expected to reach 56%.

2.4.2 Efficient Transmission / Distribution of Electricity

Transmission / Distribution efficiency in the West African region is reported at low levels (Figure 48) due to technical and non-technical losses. Although transmission losses are reported relatively low (for example, Benin: 6%, Burkina Faso: 5%, Cote d' Ivoire: 6%, Liberia: 6%, Mali: 4%) distribution losses are mainly responsible for the low efficiency of the Transmission / Distribution network, due to, a large extent, non-technical losses. For example, Benin has are reported non-technical losses at a rate of 8%, similarly in Cote d' Ivoire at 8%, 18% in Liberia, 11% in Mali, or 27% in Sierra Leone.

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Should such targets for the improvement of the T&D efficiency are met, considerable amounts of Electricity are expected to be freed up, as for instance more than 730 GWh in Benin, 4,500 GWh in Cote d'Ivoire, 2,700 GWh in Mali, or 300 GWh in Sierra Leone, as these are reported in the Energy Efficiency Action Plans. In order to reduce T&D losses all countries are implementing or plan to take measures for the rehabilitation of existing networks and in parallel apply policies for the reduction of commercial losses. In terms of electricity savings in the electricity sector, which includes Transmission and Distribution losses, savings are expected to reach on aggregate more than 8 TWh/year by 2020 and more than 16 TWh/year by 2030, excluding Nigeria, where relevant savings are expected to reach 8 and 117 TWh/year for 2020 and 2030 respectively. (Note: The figures quoted include also reduction of losses in the electricity generation process.)

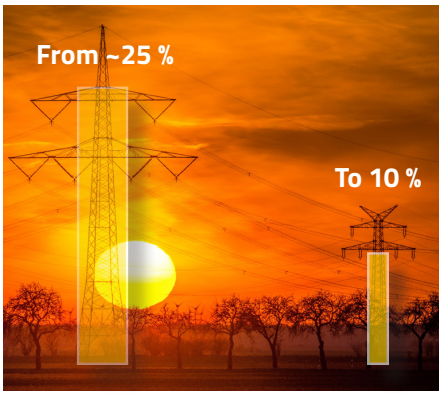
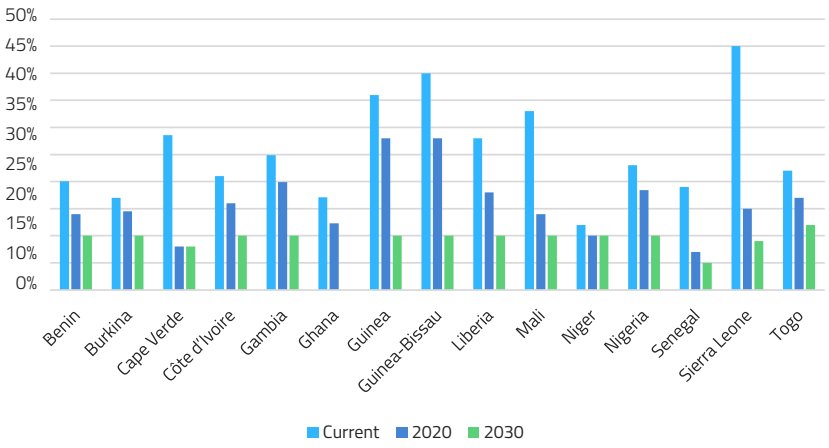


Figure 48 *Transmission/distribution losses targets*



Source: AA/NREAP/NEEAP

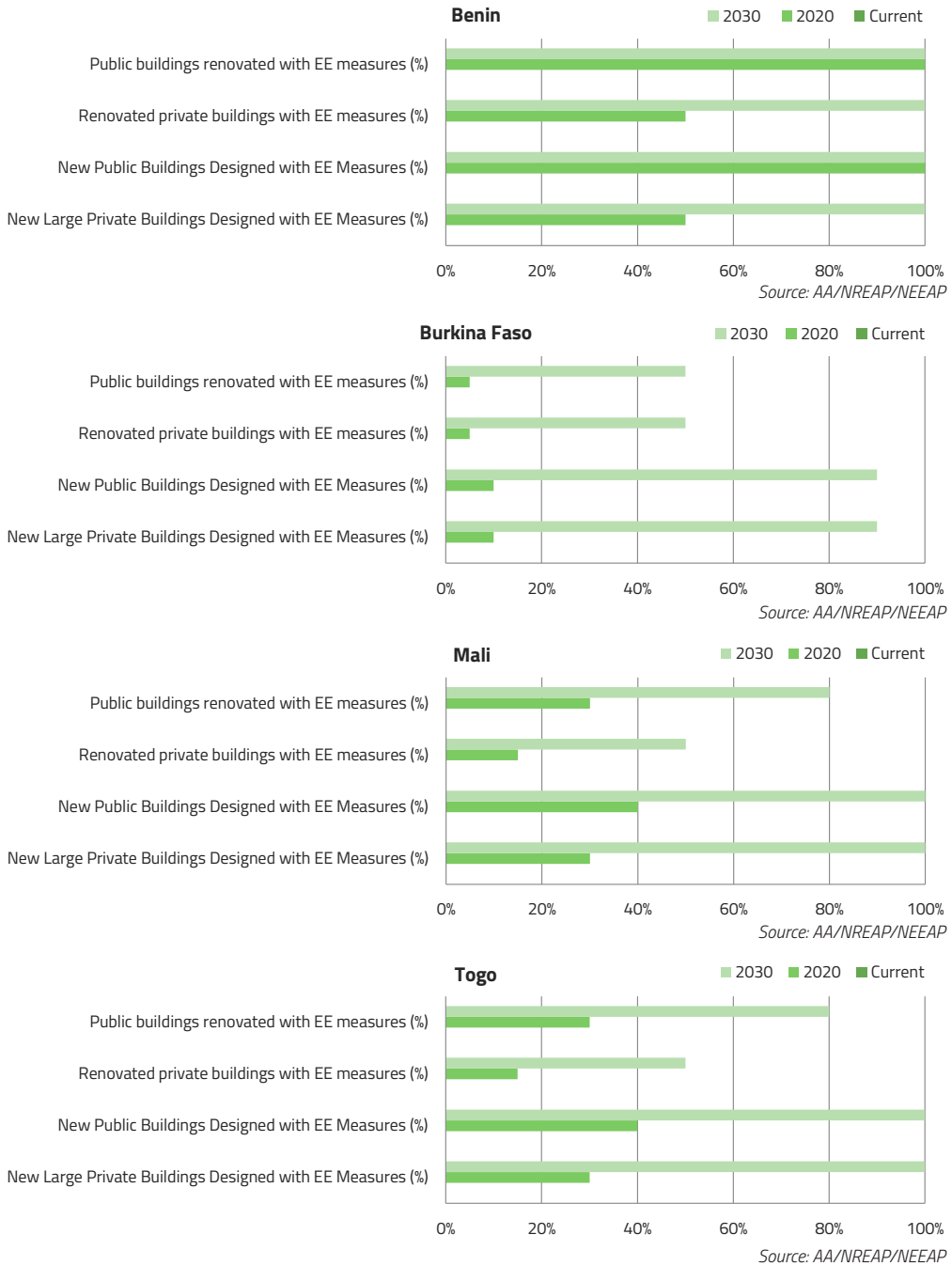
2.4.3 Building Sector

The building sector is recognized as having considerable energy efficiency potential. That is why, among financial measures, capacity building or awareness campaigns, energy efficiency policies and tools are being or are going to be implemented to exploit this EE potential. The main axes of such strategies concern:

- Development and implementation of guidelines for building owners and construction industry.
- Drafting and implementation of building codes, tailored to local conditions and construction practices, that require or encourage a high level of energy performance in new buildings.

Following Figure 49, displays the targets for efficiency in buildings in Benin, Burkina Faso, Mali and Togo, as these have been reported in the Action Plans for Energy Efficiency.

Figure 49 *Targets for energy efficiency in buildings*



2.4.4 Energy Efficiency in the Industrial Sector

More than in half of the countries have reported and quantified energy efficiency targets in the industrial sector. These countries (through the relevant NEEAPs) have reported that a large share of the industries will apply energy efficiency measures, following the performance of energy audits. Such audits and EE interventions will be aided through grants / state subsidies or other ways of support, as reported.

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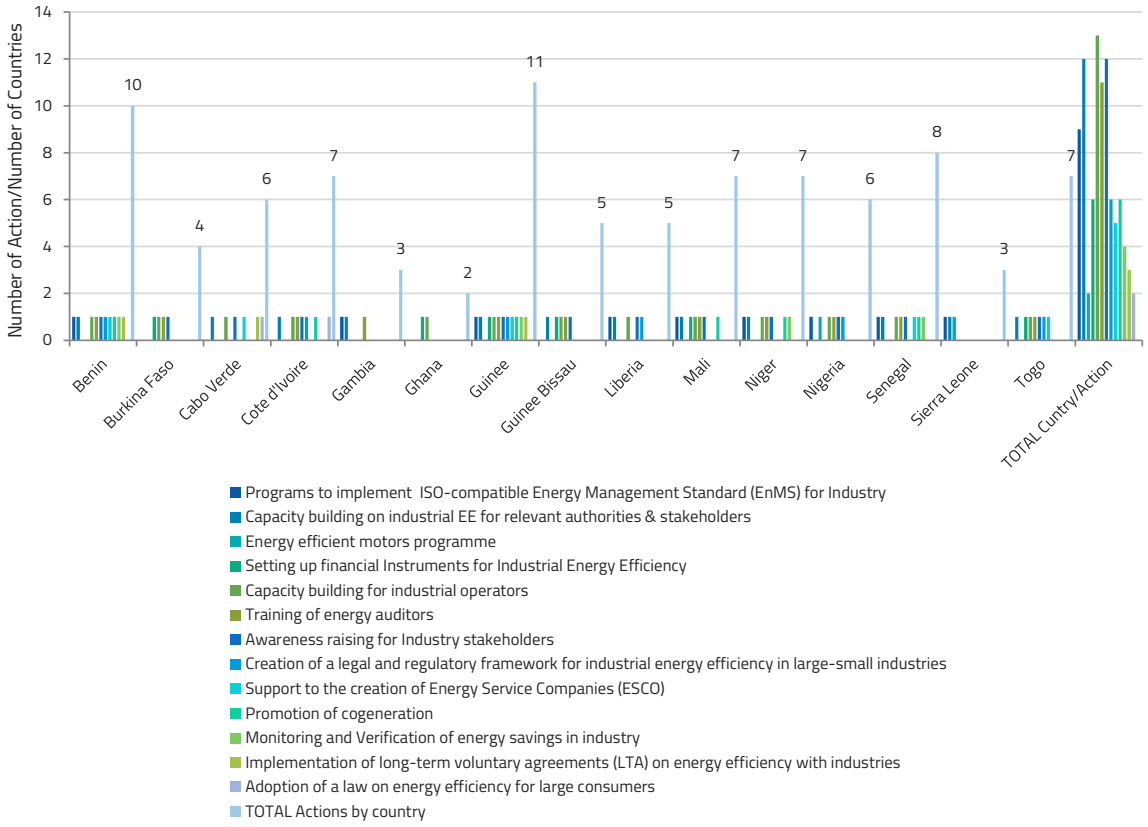
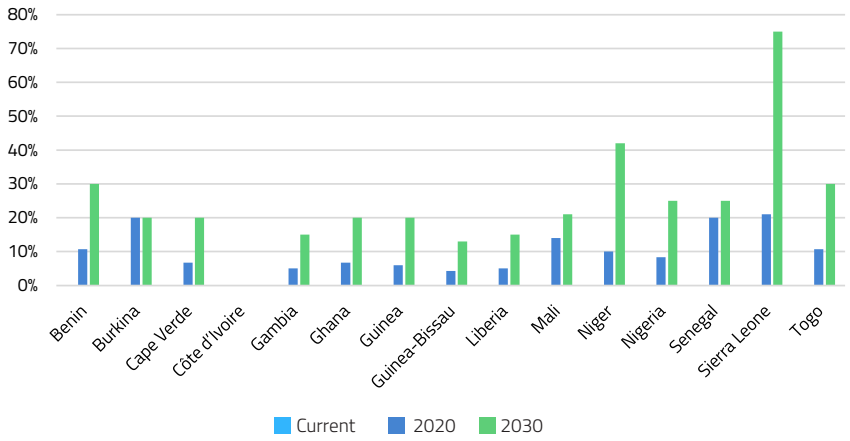
Figure 50 *Actions to tackle energy efficiency challenges in the industrial sector*



The achieved savings are expected to reach up to 40% of current energy consumption as given in Figure 51, with the exception of Sierra Leone which has reported 75% energy savings, a target, which can be considered quite optimistic, and should be further analysed.

Figure 51 *Targets for energy efficiency in the industrial sector*



Source: AA/NREAP/NEEAP

2.4.5 Electricity Savings Potential

The implementation of energy efficiency measures in the building sector, the residential sector, the industrial or the transmission and distribution of electricity sectors is expected to have a significant effect in the electricity savings potential. The reported electricity savings in different sectors are presented in Annex 3 for the countries which have reported such information.

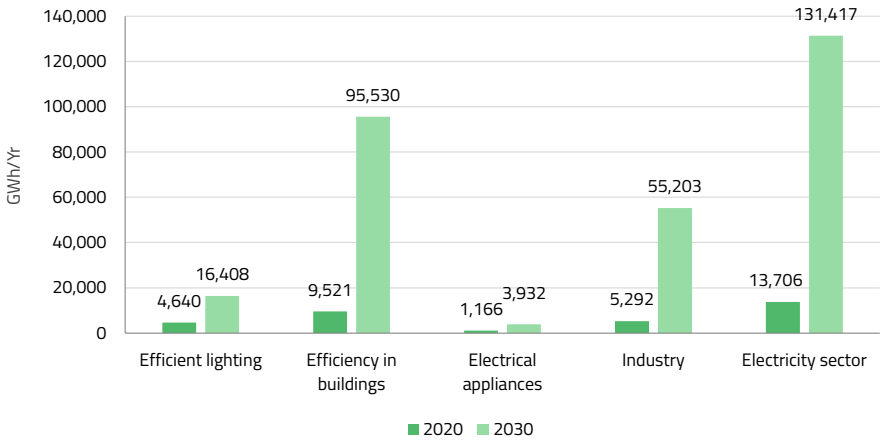
Consolidated targets for electricity saving in the lighting, building, the industrial sector, the savings through the use of efficient appliances, and the electricity sector are given Table 8. Of the overall target of 38,750 GWh in 2020, and the 307,186 GWh in 2030, 16,500 GWh and 247,000 GWh respectively are attributed to Nigeria.

Table 8 *Electricity savings potential and its "equivalent" installed generation capacity*

	Electricity savings potential (GWh)		Equivalent Installed capacity (MW) at 100% Capacity Factor	
	2020	2030	2020	2030
Benin	759	3.518	87	402
Burkina	754	2.405	86	275
Cabo Verde	55	207	6	24
Côte d'Ivoire	5,979	9,740	683	1,112
Gambia	62	366	7	42
Ghana	2,114	6,459	241	737
Guinea	378	2,975	43	340
Guinea-Bissau	14	46	2	5
Liberia	235	1,605	27	183
Mali	4,844	18,647	553	2,129
Niger	1,317	2,758	150	315
Nigeria	16,647	246,772	1,900	28,170
Senegal	2,541	6,607	290	754
Sierra Leone	374	779	43	89
Togo	659	2.273	75	260
	36,730	**305,156**	**4,193**	**34,835**

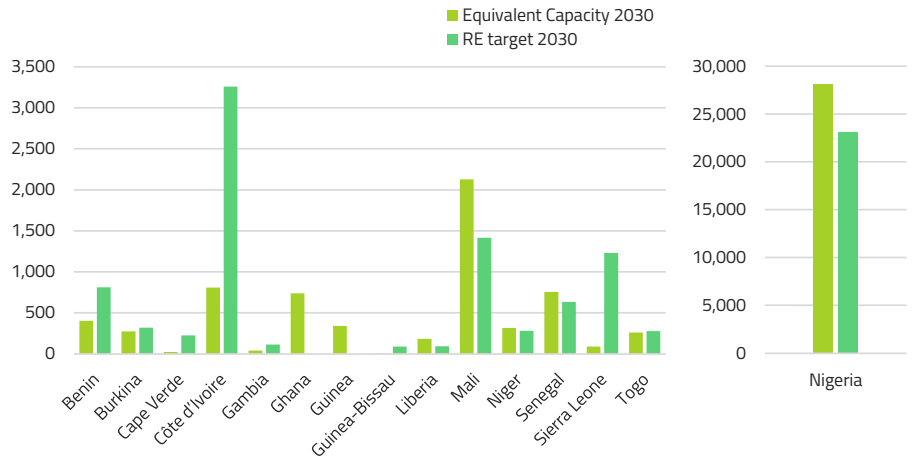
Figure 52 displays the projected Electricity savings potential in GWh/year for the 5 sectors reported, for all countries in the region. Per country targets are provided in Annex 3 of this document.

Figure 52 *Targets for electricity savings in different sectors*



The vast efficiency potential expressed through the NEEAPs can be visualized when compared with the planned on-grid renewable energy capacity in each country, as displayed in Figure 53.

Figure 53 *Efficiency potential compared with the planned on-grid RE capacity in each country*



It is apparent that the energy efficiency measures have a substantial impact either through freeing-up existing capacity or through reducing the requirement for new generation capacity in the area. For the countries which have reported electricity savings, the "equivalent" installed capacity (at a theoretical 100% capacity factor), are in excess of 2 GW by 2020 and by 5.5 GW by 2030 (with the exclusion of Nigeria, Ghana and Guinea), which translates to **an avoided installed physical capacity of more than 4 and 10 GW by 2020 and 2030 respectively. This should be compared to the approximately 14 and 32 GW for 2020 and 2030 of new Renewable Energy capacity planned in the Region (or 4 GW and 8 GW, excluding Ghana, Guinea and Nigeria), but it is much higher than the Regional Target of freeing up 2 GW by 2020.**

2.4.6 Avoided CO_2 Emissions

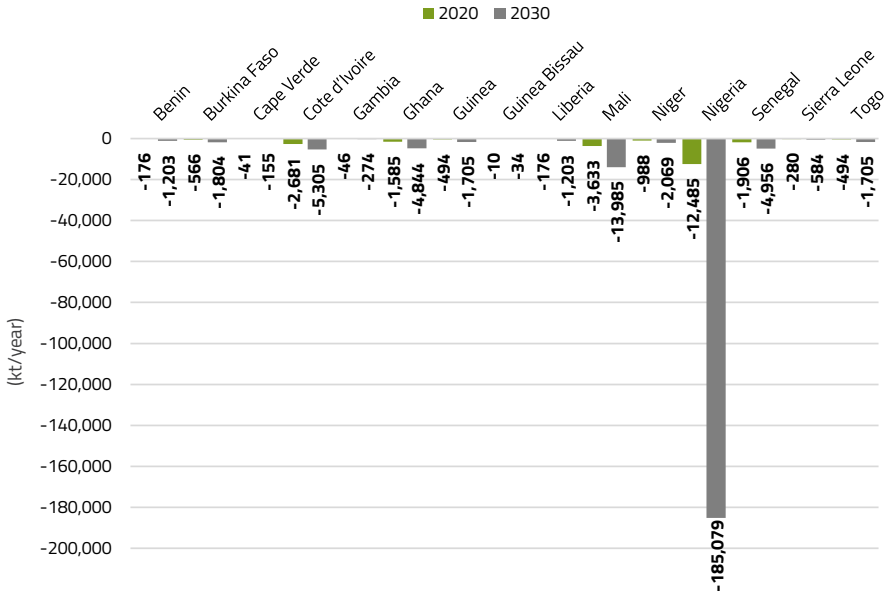
According to the Intergovernmental Panel on Climate Change (IPCC), Carbon dioxide intensity of Electricity for Africa is 0.705 kg CO_2/kWh[21]. It must be noted that the CO_2 intensity of Electricity is different for each country in the region, as the mix for the electricity production is different among the countries.

Taking into consideration the Carbon dioxide intensity for Africa, it is expected that the avoided CO_2 emissions from the countries in the region will reach **227,000 kt CO**, per year, including Nigeria, whose avoided emissions have been reported to 185.000 kT CO, per year (avoided CO_2 emissions for all countries except Nigeria are 42,000 kt CO_2 per year). Figure 54 and Figure 55 display the individual CO_2 reduction targets per country (see also Annex 4) originating only from the electricity savings.

21 http://www.ipcc.ch/pdf/special-reports/sroc/Tables/t0305.pdf

Figure 54 *Trajectory of avoided CO_2 emissions per country, per year.*

Figure 55 *Trajectory of avoided CO_2 emissions per country, including Nigeria.*



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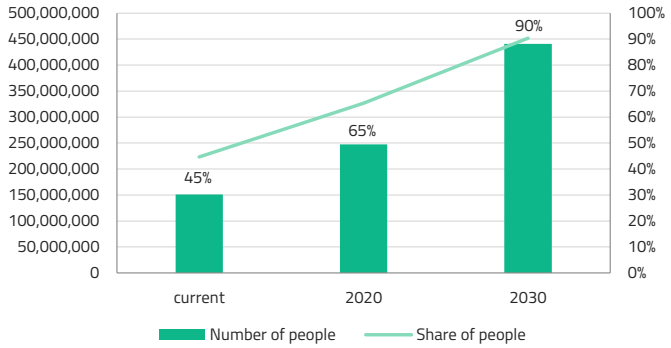
3 Aggregated Target

The aggregation of the targets of each country in the Region, as expressed in the SE4ALL Action Agendas and corresponding Action Plans for Renewable Energy (NREAP) and Energy Efficiency (NEEAP), to a large extent converge to the Regional Policies and Targets, as declared in the Regional Policies for Renewable Energy (EREP) and Energy Efficiency (EEEP).

3.1 Access to Electricity

At regional level, the target expressed through the Action Agendas translates to approximately 90% access to Electricity Services, corresponding to approximately 440 million people, as opposed to the declared universal access to electricity.

Access to electricity services



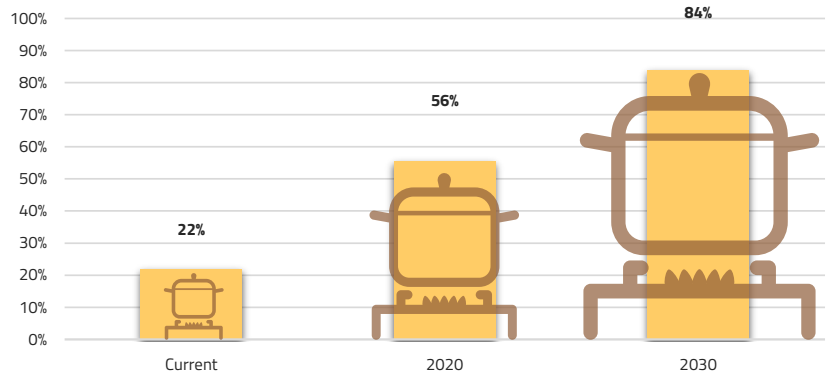
3.2 Access to Clean Cooking

POLICY STATEMENT

- Ensure universal access to Improved cook-stoves to 100% by 2020;

ECOWAS population with access to efficient and clean cooking is expected to quadruple by 2030, compared to current rates, reaching approximately 90%.

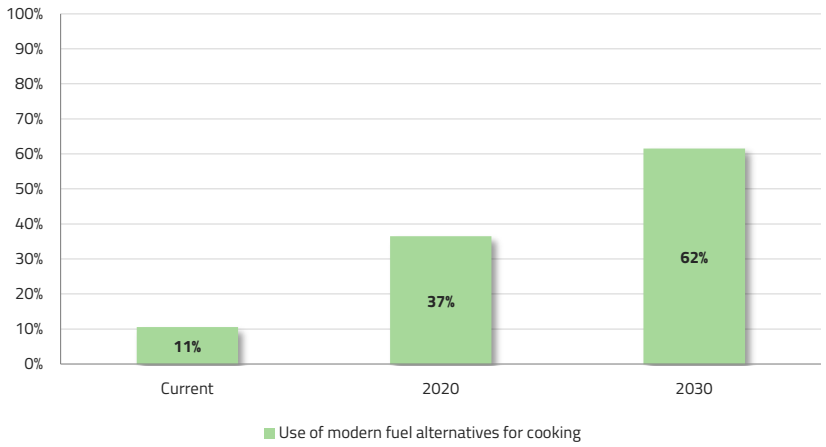
Population using efficient cooking in the region (%)



POLICY STATEMENT

- Increase the share of the population served with modern fuel alternatives, including LPG, for cooking to 36% by 2020 and 41 % by 2030;

Population using modern/alternative cooking methods in the Region (%)



3.3 Renewable Energy

POLICY STATEMENT

- Increase the share of renewable energy in the overall electricity mix including large hydro, to 35% by 2020 and 48% by 2030;
- Increase the share of renewable energy in the overall energy mix excluding large hydro, to 10% by 2020 and 19% by 2030. This will lead to the installation of 2.4 GW renewable energy generation capacity from wind, solar, bioenergy and small scale hydro power by 2020 and 7.6 GW by 2030.

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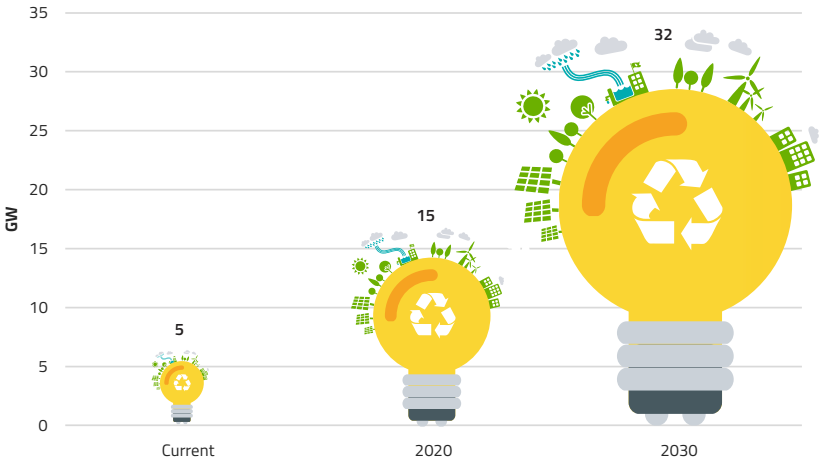
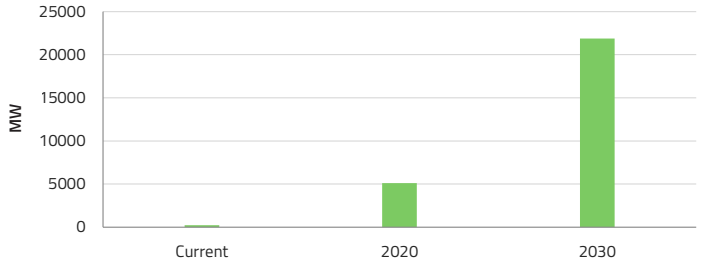
Grid connected Renewable Energy Capacity is expected to reach approximately 32 GW by 2030, more than 6 times the capacity today, through the exploitation of abundant and currently untapped Renewable Energy potential.

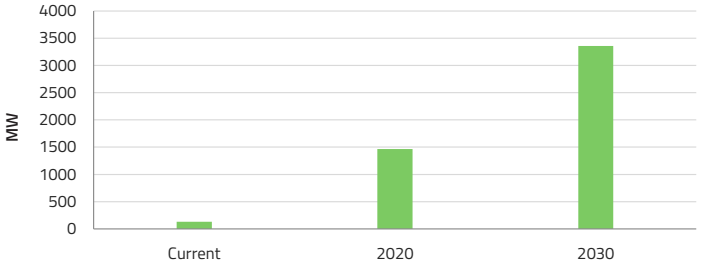
Grid connected RE capacity



Renewable energy installed capacity in MW (excluding large and medium scale hydro)



Renewable energy installed capacity in MW (excluding large and medium scale hydro) - excluding Nigeria

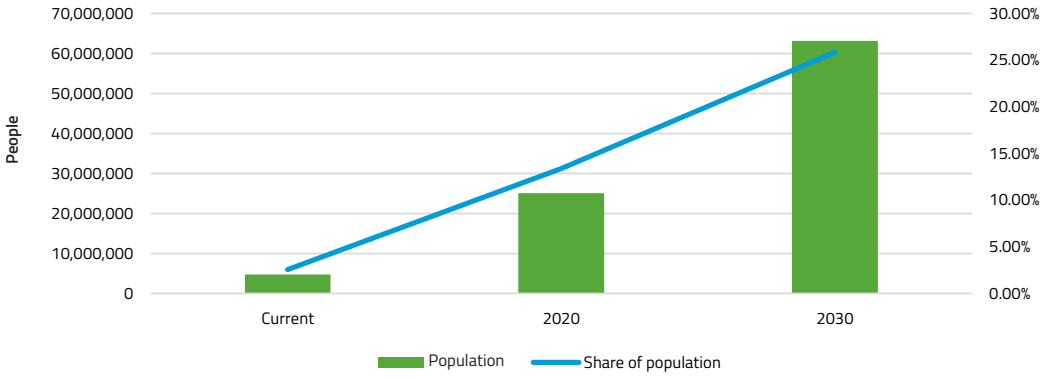


POLICY STATEMENT

For decentralized renewable energy solutions:

- Increase the share of the rural population served by decentralized renewable electricity services (e.g. Mini-Grids and stand alone systems) to 22% by 2020 and 25% by 2030.

Rural population served by decentralized renewable energy services (mini-grid / stand-alone)

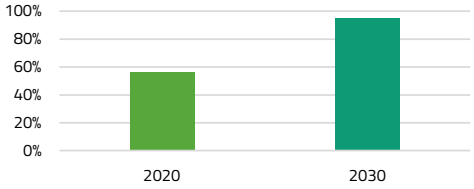


3.4 Energy Efficiency

POLICY STATEMENT

- Phase out inefficient incandescent lamps by 2020.

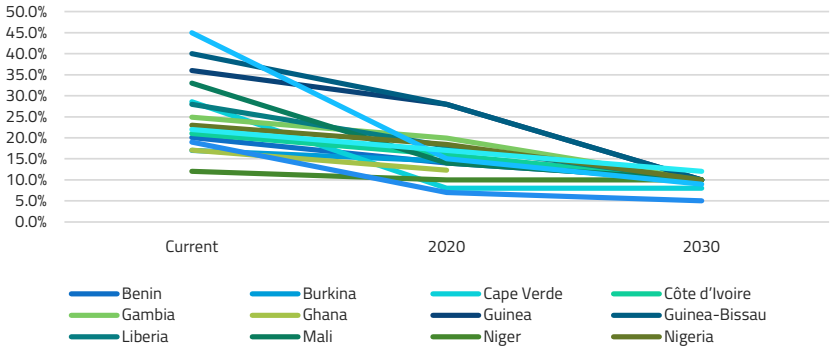
Efficient lighting targets



POLICY STATEMENT

- Reduce average losses in electricity distribution from the current levels of 15-40% to the world standard levels of below 10% by 2020.

Transmission/distribution losses



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4 Enabling Environment

Meeting the targets for Energy Access, Renewable Energy and Energy Efficiency in the ECOWAS Region requires a set of tools and principles, which will support the efforts to increase energy access through energy investments and through enhancing efficiency in the energy value chain. A first set comprises principles for creating and maintaining a functional power system that meets demand, remains financially solvent, attracts private and public investment, and provides quality service to end-users. A second set includes principles to ensure that the power sector contributes optimally to a country's national and regional agenda for environmental, economic, and social development[22]. Important constituent of the above is the involvement of all stakeholders, be it institutions involved or end-users, in terms of capacity, ownership and knowledge.

The Role of ECREEE

In order to assist ECOWAS member States to achieve their targets and increase access to sustainable energy, ECREEE is implementing a number of key programmes, ranging from the development of policies and regulations to facilitation of project-preparatory activities, intended to move promising projects closer to bankability. Capacity-building is one of the key activities provided by ECREEE. It is targeted to a large variety of stakeholders to improve awareness, quality of installations, support mechanisms and policy processes.

ENABLING PRINCIPLES

Strong, Transparent Legal and Regulatory Frameworks

Creating and maintaining an effective enabling environment requires a strong and transparent regulatory framework that facilitates both private and public investment. This framework should include a regulatory institution that is autonomous, has clear authority and capacity to fulfill its mandate, and is held accountable for its decisions and actions.

Creditworthy Off-takers

Efficient, financially solvent off-takers mitigate investor risk and encourage increased private sector participation.

Cost-Reflective Retail Tariff Structures

Investments in the power sector will only be sustainable if the tariff structure accurately reflects costs and risks, and provides a rate of return that encourages continued private sector engagement. This must be carefully balanced against the critical need to protect consumers, ensure affordability, and expand electricity access.

Technical and Commercial Efficiency

Improved technical and commercial efficiency in the electricity sector will enable delivery of more services to more consumers; lower costs throughout the supply chain; and increased quality and commercial viability. Efficiency can be improved through interventions including infrastructure investment and maintenance, improved metering and bill collection, demand-side management, and consumer education.

Clear and Transparent Procurement Processes

Procurement processes that integrate international best practices such as fair and competitive bidding, life-cycle cost analysis, and best-value determination will increase investor confidence, lower costs, and facilitate sustainable, longer-term investments.

Sound, Strategic and Integrated Power Sector Planning

Effective planning helps ensure the development of a resilient and least-cost power system that continues to meet demand over time. Effective planning will prioritize an optimal mix of energy resources to meet the expected load, new or extended transmission and distribution infrastructure, energy efficiency measures, and off-grid solutions.

Streamlined and Transparent Processes for Project Development

Streamlining and clearly communicating required steps to achieve essential project components such as land acquisition, feasibility studies, standards compliance, etc.

Source: USAID, Power Africa

22 https://www.usaid.gov/powerafrica/enablingenvironmentreforms

Flagship programmes implemented by ECREEE include the Rural Electrification Programme, the ECOWAS Small-Scale Hydro Power Programme (SSHP), the ECOWAS Solar Thermal Energy Programme, the West African Clean Cooking Alliance (WACCA), EEEP and the ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN).

4.1 Supporting Mechanisms

Through local and Regional efforts and Initiatives, the ECOWAS member States have started developing a number of tools, which target in developing a favorable environment, which will allow them to move forward in terms of the Human Development constituents, related to Energy. For these constituents, such as Access to Energy, Access to efficient and healthier means for cooking, Exploitation of Renewable Energy Sources, Improvement of Energy Efficiency, to be developed and improved, besides the financial support, an enabling framework is required in terms of policy arrangements and capacity. Following paragraphs present, not all, but certain actions, policies, or tools, which are considered as important, since they have the potential for allowing these constituents to develop.

This next section provides a summary overview of the supporting mechanisms in the Region and is not intended to provide most detailed information. Its scope is to give a short summary of the enabling environment instruments, such as legal and legislative framework, Renewable Energy and Energy Efficiency institutional arrangement, among others, in order to allow policymakers to streamline their actions towards the ECOWAS Regional goals.

4.2 Country Policies for the Energy, Electricity and Renewable Energy Sector

Prior to the Action Agendas ECOWAS Countries have expressed their commitment to developing the Energy Sector and Renewable Energy Sources through Strategies and Policies. Elements of these are provided in the following section.

Benin

Benin's Energy Policy and Strategy, as well as the **Policy for Rural Electrification**, both issued in March 2004, adopted by the Council of Ministers, aimed at:

- Optimal exploitation of energy resources for the production of electricity;
- Give the possibility to the people to have access to electricity at low cost;
- Accelerating the electrification of rural areas;
- Increased production capacity and extensions of transmission and distribution networks.

Strategic Plan for the Development of the Energy Sector in Benin, adopted in October 2009, aiming for the development of the Energy Sector through:

- The Promotion of rural electrification, energy management and bioenergy supply chains;
- The establishment of a pricing and financing policy for the sector;
- Development of institutional and regulatory capacities and capacity building

National Policy on Energy Management (PONAME), adopted in October 2009. The vision of PONAME was to "Make energy management a lever for improving the competitiveness of the national economy and social welfare", defining three specific objectives, the optimization of the energy supply, of the consumption of energy, and the strengthening of the institutional and regulatory framework of the energy sector. Renewable Energy is one of the cornerstones of PONAME.

A new institution for the development of Renewable Energy Sources was created in 2014, the National Agency for the Development of Renewable Energies and Energy Efficiency (ANDER). It was created, with a mission to facilitate the effective promotion and accelerate the development of renewable energy.

Burkina Faso

Renewable Energy Policies in Burkina Faso are covered by the Sectoral Energy Policy (POSEN 2014-2015) or the Accelerated Growth and Sustainable Development Strategy (SCADD 2011-2015). Decree No. 2013-104 / PRES / PM / SGGCM of 7 March 2013 on the responsibilities of members of the Government, including those of the Ministry in charge of energy, stipulates that the Ministry in charge of Energy is responsible for the promotion of new and renewable energies. The Ministry of Mines and Energy, operates through the Directorate General of Energy, which is composed of four technical divisions:

1) Direction of Renewable Energy and Domestic Energy; 2) Directorate for the Promotion of Energy Efficiency; 3) Directorate of Electrical Energy and Promotion of Rural Electrification; And 4) Hydrocarbons Directorate. In the framework of facilitation of the use of Renewable Energy Sources, Law 051-2012 / AN has been adopted and implemented from January 1st, 2013, on a five-(5) year exemption of customs duties and VAT on solar energy equipment.

The challenge set out in POSEN is to increase the share of renewable energies in the energy mix of Burkina Faso to 50% by 2025. POSEN advocates the promotion of renewable energies through the following mechanisms:

- Adoption of a law on renewable energy;
- Creation of a National Agency for Renewable Energies and Energy Efficiency (ANEREE).

The Accelerated Growth and Sustainable Development Strategy (SCADD 2011-2015) in its section on energy stipulates that attention will be given to the development of renewable energy, in particular solar energy, the development of interconnection with Countries of the sub-region and the promotion of cooperation. The Order 2013-057 / MME / SG / DGE of 29 March 2013 on the creation, organization, composition, functions and functioning of the Interministerial Committee responsible for drawing up and monitoring the SE4ALL (CIESPA) strategy and action plan for Burkina Faso, which is aimed to be the driving lead for the Energy Sector of the country.

It should be noted that with focus on the development of RE in the country the PPP development strategy was drawn in 2011, followed by Law 020-2013 / AN on the legal regime of the PPP.

The enabling environment for Renewable Energy is yet weak in Burkina Faso, as there are no laws or regulations specific to the field of renewable energy. However, the synergy of actions with policies and initiatives at international and regional level, such as the SE4ALL initiative, the ECOWAS Renewable Energy Policy, or the Regional Programme for the Development of Renewable Energy (WAEMU/PRODERE) should help to alleviate this situation.

Cabo Verde

The vision of Cabo Verde for the energy sector is expressed in Cabo Verde's Energy Policy Document (MECC, 2008), is "Building a safe, efficient, sustainable and non-fossil fuel dependent energy sector", which is based on four fundamental pillars: Energy security and reduced dependence on imports, a commitment to renewable energies through Investment in and adoption of renewable and alternative energy technologies, with a consequent reduction in dependence on fuel imports, Sustainability and Efficiency.

The energy policy document quantifies RE related objectives, one of which is to cover 50% of electricity needs from RE and to have at least one island with 100% renewable energy by 2020.

The strong focus on renewable energies is achieved by the publication of Decree-Law no. 1/2011 of January 3, which is to create a regime of licensing and exercise of specific activity and adapted to renewable energies. The Decree, which followed the Law, establishes a framework for investment incentives, tax incentives, and customs incentives. The law also defines a special treatment for micro-generation which includes measures such as exemption from environmental impact study and tax benefits. It has also envisaged the preparation of a Renewable Energy Master Plan (PDER) to be reviewed every five years, the elaboration of a Strategic Sector Plan for Renewable Energies (PESER), and the definition of Renewable Energy Development Zones (ZDER). The PDER was prepared and approved in 2011. The PESER was approved by Resolution of the Council of Ministers no. 7/2012 of 9 December. In addition, Articles 13 and 14 of Decree- no. 1/2011, related to tax and customs benefits, were revoked and updated with a new Code of Tax Benefits contained in Law no. 26 / VIII / 2013, while Decree-no. 18/2014 which amended mended Decree-Law No. 1/2011 allowed greater involvement of the Economic Regulation Agency in decision-making processes, in partnership and collaboration with the Directorate-General for Energy.

It is apparent that in n recent years, there has been an increasing dynamism in terms of investments in the renewable energy sector. The results obtained led to an even more ambitious government bid to reach the goal of 100% renewable electricity by 2020.

The Action Agenda of Cabo Verde has become a law (Imprensa Nacional de Cabo Verde, https://kiosk.incv.cv/1.1.61.2083/) of the country indicating the strong commitment of the Country in the SE4ALL initiative.

Cote d'Ivoire

The energy sector in Côte d'Ivoire is part of a vision of sustainable development through the adoption of sustainable production and consumption patterns to include communities in low-carbon growth strategies. This will continue to ensure that people have access to energy at optimal cost, in quality and quantity sufficient to meet their energy needs.

To achieve this, several national regulations have been adopted to regulate the energy sector in Côte d'Ivoire, notably:

- Act No. 65-255 of 4 August 1965 on the protection of wildlife and hunting;
- Law No. 96-766 of 3 October 1996 on the Environment Code;
- Law No. 2014-427 of 14 July 2014, establishing the Forestry Code of Ivory Coast;
- Law No. 2014-132 of 24th March 2014 relating to the electricity code.

Based on these laws, the whole of the regulation is built up with decrees or ordinances which are texts of application or orientation of the political decisions to regulate the energy sector in Cote d'Ivoire.

The Government of Côte d'Ivoire has initiated an ambitious programme of rural electrification, known as the National Rural Electrification Programme (PRONER), which began in July 2013. This programme aims to electrify, on the basis of objective criteria, by 2016, all the localities with more than 500 inhabitants and all the localities in Côte d'Ivoire by 2020. The rate of access to the envisaged 2020/2025 horizon is 100%.

The government's commitment in its national strategy is to increase the energy efficiency through "Developing renewable energies (hydropower, biomass, biogas, solar, combined cycle development, etc.) and realizing Energy savings", based on Law No. 2014-132 of 24 March 2014.

The Gambia

Renewable energy policy objectives of The Gambia are expressed within the framework of an overall national energy policy. There is no standalone renewable energy policy. In 2014, a review of the 2005 Energy Policy has been completed and the National Energy Strategy and Policy have been validated for adoption on November 25th, 2014. This new "National Energy Policy " articulates two renewable policy objective strands, including:

Promotion of the utilisation of renewable energy technologies through a number of policy elements, aiming to:

- Popularize the use of solar photovoltaic (PV), wind turbine technologies, and thermal systems to provide power for various applications particularly in rural areas;
- Encourage use of RE as alternative domestic fuel resources;
- Facilitate donor intervention in the provision of grants, interest-free loans as well as fiscal incentives for the acquisition of renewable energy equipment;
- Implement RE law recommendations for feed-in-tariffs to attract investment in the RE power plants;
- Publish and gazette Renewable energy FiT.
- Regulate and promote the utilisation of renewable energy technologies as well as local manufacturing through the formulation of standards for imported RE equipment into the country, and, in parallel, enhance institutional and human capacity in RE technologies.

Ghana

Over the years, Ghana has pursued several policies and programmes to accelerate the growth of the economy and raise the living standards of the people. These include: Ghana Vision 2020: The First Step (1996-2000); the First Medium-Term Plan (1997- 2000); Ghana Poverty Reduction Strategy (2003-2005); and the Growth and Poverty Reduction Strategy (2006-2009). Under these strategic programmes, substantial progress was made towards the realisation of macro-economic stability and the achievement of poverty reduction goals[23].

The current medium-term development policy framework, the Ghana Shared Growth and Development Agenda (GSGDA), 2010-2013 seeks to accelerate employment creation and income generation for poverty reduction and shared growth. The Vision of Ghana's Energy Sector, as presented in the "**Energy Sector Strategy &**

23 Rapid Assessment Gap Analysis, Ghana, 2012

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Development Plan, 2010" is "to ensure availability of and universal access to energy services and for export by 2020."

The Ministry of Energy (MoE) has the mandate on behalf of Government to ensure a high performing energy sector to underpin national economic growth. The MoE is responsible for formulating, coordinating, monitoring and evaluating policies, programmes and projects for the power sub-sector in particular and the energy sector in general. MoE is also the institution charged with the implementation of the National Electrification scheme (NES) which seeks to extend electricity to all communities in the long term.

Stakeholders in the Energy sector include:

- **Power Generation**: the **Volta River Authority (VRA)**, a state-owned power generating utility, **the Bui Power Authority (BPA)**, another state-owned institution, as well as some Independent Power Producers (IPPs).
- **Power Transmission:** the **Ghana Grid Company (GRIDCo)**, a state-owned entity that has the exclusive mandate to operate the National Interconnected Transmission System (NITS) as an Independent System Operator (ISO), which is also the Market Administrator for the Electricity Market.
- **Power Distribution**: Electricity Company of Ghana Limited (ECG), a state-owned company and the **Northern Electricity Department** (NED), which is VRA's distribution agency.
- The **Gambia Public Utilities Regulatory Authority** (PURA) Act of 2001, provides for the establishment of the **PURA** authority to regulate the activities of providers of certain public utilities in the various economic sectors.
- The **Energy Commission (EC)**, a state institution, responsible for the regulation, management, development and utilization of energy resources in Ghana. EC is the licensing authority for the generation, transmission, wholesale supply, distribution and sale of electricity and natural gas.

Guinée Bissau

The Government of Guinea-Bissau aims to have programs aimed at implementing an energy model based on economic rationality and sustainability, combining energy efficiency and Renewable energy sources. At the same time, the aim is to reduce the country's energy dependence and ensure security of supply by promoting a balanced energy mix.

Yet, there is not a specific policy framework and / or associated plan for Renewable energy and Energy Efficiency (EE) in the country. So far a number of laws have been adopted aiming to allow development of the RE and EE in the country, such as:

i. Official Gazette, n°18, May 19, 2004 - Direct environmental management plan;
ii. Decree-Law no. 2/2007, 29 June 2007 - Determination of the structure of the energy sector, its organization and the principles applicable to the different forms of energy;
iii. National Plan for the development of domestic energy in Guinea-Bissau (2005);
iv. National Strategic Poverty Reduction Strategy Paper (DENARP) / Poverty Reduction Strategy (2005);
v. Energy Master Plan and Electric Energy Production and Distribution Infrastructure Development Plan (2011);
vi. MICROGRID project (financed by the European Union's COOPENER programme) for hybrid system conception for microsystems with renewable energies;
vii. Emergency programme for the electric sector of Guinea Bissau (2014);
viii. Energy Master Plan for the development of infrastructures for the production and distribution of electric energy in Guinea-Bissau (finalized, to be adopted).

The most important documents for the development of RE are the Energy Master Plan for the development of infrastructures for the production and distribution of electric energy in Guinea-Bissau, finalized and lacking only the adoption, and the National Strategic Document for the Reduction Of Poverty (DENARP), which includes the promotion and development of renewable energies as an important factor for the development of the country.

Guinée

In general, all sectoral policies (Infrastructure, Energy, Basic Social Sectors and Productive Sectors of the Economic Sphere of the Poor) are initiated with a view to reducing poverty

and achieving the Millennium Development Goals (MDGs) by 2015. The national strategy for achieving the MDGs by 2015 (SN / MDG- 2015) and its medium-term operational instrument, the Poverty Reduction Strategy Paper (PRSP), are the main policy frameworks underpinning the National Programme for Population Access to Modern energy services.

At the Energy sector level, various documents on sectoral policies and strategies have been developed by the Guinean authorities with the support of international partners, namely: The Energy Sector Master Plan (2006); Tariff Study of the Energy Sector (2009); The EDG Business Plan (2009); The Energy Policy Development Letter (LPDSE, 2009); The Integrated National Programme for Access to Energy Services (PRONIASE), 2011); The Diagnosis and Recovery Plan of the Electricity Sector in Guinea (2011); and the PSDSE 2009 policy statement revised in 2012. The Energy Sector Development Policy Letter (LPDSE 2009) and the 2012 LPEDSE, present a 20-year vision (time horizon 2025), including the supply and demand of electric power, and takee into account issues related to energy efficiency and the development of renewable energies.

To reduce barriers to international and domestic private investments, the Government has established an "Investment Promotion Agency for Private Partnerships (APIP) in December 2011.

Liberia

The GOL has since 2009, placed priorities on accelerating the expansion of electricity access to the population and improve supply of reliable services essential for economic growth. Building upon the National Energy Policy of Liberia (NEPL) and the initial results achieved in rebuilding the electricity systems destroyed by the Liberian civil war, the GOL has an ambitious strategy to reach electricity coverage of at least 70 percent of the population in Monrovia, and 35 percent nationwide by 2025 and 100 percent nationwide by 2030.

Currently, the institutions in the electricity sub-sector in Liberia comprise: the Ministry of Lands, Mines and Energy (MLME), the Liberia Electricity Corporation (LEC) and the Rural and Renewable Energy Agency (RREA).

The RREA Act: On July 6, 2015 the Rural and Renewable Energy Agency (RREA) was established, dedicated to the commercial development and supply of modern energy services to rural areas with emphasis on locally available renewable resources. The RREA's mandate includes integrating energy into rural development planning; promotion of renewable energy technologies; facilitating delivery of energy products and services through rural energy service companies (RESCOs) and community initiatives;

The **2015 Electricity Law of Liberia**, aiming to the transformation of the Electricity sector in Liberia and provide the required background for institutional reforms that provide the enabling environment for sustainable power sector development.

Mali

Regarding the legislative and regulatory framework of Mali, forming a basis for the effective implementation of the SE4ALL initiative, it is composed of a series of laws, ordinances, decrees, such as:

i. Ordinance No. 00-019 / P-RM of 15 March 2000 on the organization of the electricity sector, as amended by Law No. 05-019 of 30 May 2005 and its Implementing Decree No. 00- 184 / P-RM of 14 April 2000;

ii. Reference framework for rural electrification adopted in 2003;

iii. Reference framework for domestic energy adopted in 2003;

iv. Decree No 02-107 / P-RM of March 5, 2002, establishing requirements for the electrical installations;

v. Law No. 10-028 promulgated in July 2010, on the exploitation of forests on the basis of an approved management and management plan;

vi. Decision No. 2014-0255 / ME-SG of 05 October 2014 on the creation of the National Multi-sectoral Energy Group (GMN);

vii. Decree No. 2014-0816 / P-RM of 27 October 2014 on VAT, duties and importation taxes exemption of renewable energy equipment.

In policy and national strategy, the energy policy reference framework is governed by the NIP adopted in 2006 with the overall objective of contributing to the sustainable development of

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the country through the supply of energy services to more people at lower cost and promoting socio-economic activities.

In addition and beyond the energy sector, the Strategic Framework for Growth and Poverty Reduction, constitute a single reference framework for the development of policies and strategies, covering other major aspects of development such as Economic growth and improvement of social justice and creation of conditions for prosperity.

Niger

The latest Energy Policy Statement was promulgated in 2004 by Decree 2004-338 / PRN / MM / E, which, taking into consideration latest developments and trends at national, regional and international levels, was updated to the "Energy Sector Policy Statement (ECD)" dated 4 August 2014, stating that "with regard to the low level of access to modern energy services and the driving role of energy in the context of sustainable development, the Government is committed to rapidly expand efforts to ensure the population's well-being and the country's economic growth". The overall objective of energy policy is to contribute to poverty reduction through sustainable access to modern energy services in all socio-economic sectors.

The energy legislation in Niger has been in active development for some time, with legislative texts being revised. The main documents governing the functioning of the electricity subsector comprise:

- The Concession Treaty of 3 March 1993, which delegates the management of the electricity utility to NIGELEC;
- Decree 2001-168 / PRN / MME of 30 August 2001 adopting the Letter of Sectoral Policy in the field of electricity;
- The Electricity Code promulgated by Law 2003 - 004 of 31 January 2003;
- Decree 2004-266 / PRN / MME of 14 September 2004 laying down detailed rules for the application of the Electricity Code.

The Electricity code of 2003 is being updated to take into account ensuring and encouraging technological progress; rational use of electrical energy; or, contribution to sustainable development.

The exploitation of renewable energies is supervised by the DERED of the DGE and governed by several administrative documents, such as:

- Order 000005 / ME / DE / ENR of 29 April 2002 establishing an approval for the supply and / or installation of New and Renewable Energies (ENR) equipment in Niger;
- Decree 2004-031 / PRN / MME of 30 January 2004 adopting the national strategy and action plan on renewable energies;
- Decree 2010-004 / PRN / MME of 04 January 2010 adopting the reference programme for access to energy services (PRASE).

The national strategy and action plan on renewable energies adopted by Decree 2004-031 / PRN / MME of 30 January 2004 is setting objectives, such as promotion of renewable energy systems, reduction of pressure on forest resources , promotion of rural electrification using renewable energy, promotion of education, training, research and development of renewable energies., Niger, as a member of ECOWAS, follows regional policies and translates them into national legislation, benefiting from this way of collective reflection at the regional level.

Since 2009, the efficient supply of modern fuels for domestic use is part of the National Programme of Reference of Access to Energy Services (PRASE). Since 2015, Niger has a draft National Programme for Domestic Energy. The development of domestic energy is also guided by the DERED. The priority actions identified in Niger are the dissemination of improved large-scale fireplaces, the promotion of butane gas, and support activities for the promotion of clean energy at households.

In terms of rural electrification, the legislative framework includes the law and decree of 2013 establishing the ANPER. In addition, as of 10 June 2015, the Government adopted Law 2015-39 on the introduction of the Specific Electricity Tax (TSE), intended to finance rural electrification.

Public Private Partnerships (PPP) in Niger are governed by two main documents, namely:

- Law 2011-30 of 25 October 2011 on the general regime of public-private partnership contracts in the Republic of Niger; and
- Law 2014-02 of 31 March 2014 on tax, financial and accounting rules applicable to Public-Private Partnership contracts.

Nigeria

In recent years Nigeria's electricity sector has gone through a major transformation phase, as a result of power sector reforms starting from 1999. This has led to the enactment by the national parliament of the Electric Power Sector Reform (EPSR) Act in 2005, including the unbundling of the Nigerian Electric Power Authority (NEPA), resulting to the creation of 18 new successor companies comprising, 6 generation companies, 1 transmission company and 11 distribution companies, and an 18 months transition through the establishment of the Power Holding Company of Nigeria (PHCN), the creation of the Nigerian Electricity Regulatory Commission (NERC) and the Rural Electrification Agency (REA).

The main objective of the reform was to reduce the cost of doing business in Nigeria via better management of the electricity industry by the private sector, as well as attracting new private investment in the industry, which could ensure provision of quality and dependable power supply to the economy for industrial, commercial and socio-domestic activities at efficient cost. The reform is further aimed at improving the efficiency of the generation, transmission and distribution networks which is in a comatose state; all these should provide Nigerian citizens with basic and affordable infrastructure to enable them to create employment for themselves.

More than thirty (30) draft policy documents have been formulated by various actors in the energy sector. However, only very few of these policy documents have been approved and enforced up to 2015, including the National Electric Power Policy (NEPP), 2002; the National Energy Policy (NEP), 2003; Rural Electrification Policy Paper, 2009; Roadmap for Power Sector Reforms, 2010. With specific reference to renewable energy and energy efficiency, the Federal Government of Nigeria in May 2015 approved the National Renewable Energy and Energy Efficiency Policy (NREEEP) as well as the National Determined Contribution (NDC), 2015 which established Nigeria's commitment to greenhouse gas emission.

The Federal Ministry of Power, Works and Housing (FMP) is responsible for ensuring a power sector that fully supports the socio-economic needs of the Nation. The main goal of the Ministry is directed at initiating, formulating, coordinating and implementing broad policies and programmes on the development of electricity generation from all sources of energy.

The Nigerian Electricity Regulatory Commission (NERC) was established as an independent regulatory agency in 2005 under the EPSR Act 2005. Its mandate is to monitor and regulate the electricity industry of Nigeria, issue licenses to market participants and ensure compliance with market rules and operating guidelines.

Senegal

The Ministry of Energy and Renewable Energy Development is responsible for the implementation of the policies defined by the Head of State in the field of energy. Within this framework, the Ministry develops the country's energy supply plan and ensures its deployment by ensuring coordination between various stakeholders. It is also responsible for granting licenses and concessions.

The Electricity Sector Regulatory Commission (Commission de Régulation du Secteur de l'Electricité) is an independent body of the Ministry in charge of Energy, which is responsible for regulating the production, transmission, distribution and sale of electric power, aiming to: promote the rational development of the electricity supply; ensure the economic and financial balance of the electricity sector and ensure its sustainability; ensure the financial viability of the electricity companies by allowing them to achieve a normal rate of return on their investments; promote private sector competition and participation in the production, transmission, distribution and sale of electricity; ensure protection of consumers' interests and ensure the protection of their rights with respect to pricing, supply and quality of electrical energy.

Sierra Leone

The primary policies, strategies and plans of Sierra Leone are:

i. The National Energy Policy (NEP, 2009), which includes a renewable energy framework;
ii. The National Energy Strategic Plan (September, 2009);
iii. National Renewable Energy Policy of Sierra Leone (NREP), which clarifies and extends the 2009 National Energy Policy and Strategic Plan with goals, policies, and extensive measures for renewable energy.

In addition, Sierra Leone has embarked to the SE4ALL Action Agenda (2015), as well as the Economic Community of West African States (ECOWAS) initiatives (2012 onward), including the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP) (2012-2013), which include minimum targets and scenarios for renewable energy (RE) and energy efficiency (EE).

The Ministry of Energy (MoE) is the custodian of energy services in Sierra Leone with the mandate to chart out policies and coordination of these services. The MoE has produced a national energy policy to accompany the national energy strategic plan. Other institutions involved in the energy sector are the Ministry of Agriculture, Forestry and Food Security (MAFFS), which has a key role in matters related to bioenergy and crop-related energy issues.

The 2009 Energy Policy and the National Electricity Act (NEA), 2011, guide the energy sector in Sierra Leone. The NEA mandated unbundling and restructuring of the existing public utility company into two bodies: the Sierra Leone Electricity Generation and Transmission Company (EGTC) and the Electricity Distribution and Supply Authority (EDSA) .

NEA established the Sierra Leone Electricity and Water Regulatory Commission (EWRC) to regulate the provision of electricity and water services to consumers. EWRC is responsible for issuing licenses, promoting fair competition among public utilities and establishing electricity tariffs. The Commission has been established and operates within the Ministry of Energy.

The National Renewable Energy Policy of Sierra Leone (NREP) has been developed, approved by Cabinet and had been expected to be ratified by Parliament in 2016. Aiming to enhance the use of RE, the GoSL aims to take steps to further clarify, simplify and streamline policies and regulations for other forms of on-grid and off-grid renewable energy, and to clarify the roles of responsible units of government. These will include such steps as standardization and simplification of utility-scale on-grid Power Purchase Agreements (PPAs), mini-grid concession terms, and other enabling actions.

The Sierra Leone Electricity and Water Regulatory Commission (SREP), as it was mandated in the National Electricity Act (2011), was established In 2016.

Togo

For the Government of Togo, poverty reduction remains the greatest challenge for human and social development. This vision is reflected in the main Policy framework such as the National Long-Term Development Strategy focusing on programs and Sectoral Strategies for Agriculture, Energy, Drinking Water and Sanitation, etc.[24]

The energy sector is controlled in its entirety by the State and several Ministries and institutions, including among others:

- **Ministry of Mines and Energy** in charge of the management of the mining and energy sectors; With its divisions (Directorate General of Mines and Geology, Directorate General of Hydrocarbons, Directorate General of Energy, Directorate of Common Affairs and Authority of Regulation of the Sector of Electricity (ARSE));
- **Ministry of Trade and Promotion of the Private Sector** supervises companies importing and distributing petroleum products;
- **Ministry of Environment and Forest Resources** responsible for the management of the environment, the sustainable use of natural resources and the protection of the environment;
- **Communauté Electrique du Bénin** (CEB) assigned with the import, production and transmission of electric power, as well as the **Compagnie Energie Electrique du Togo** (CEET) responsible for the Distribution and marketing of electric power.

The electricity subsector is governed by two (02) Basic Laws:

- The **Benin-Togo Code of Electricity**, which is an international agreement between Benin and Togo, existed since July 1968 and revised in December 2003, to comply with the new realities faced by the sub-sector, in particular with the opening of the Electricity Production sector to Independent Power Producers (IPP) and giving the Single Buyer Status to CEB;
- Law 2000-12 (of 18/07/2000) related to the liberalization of the electricity sector and the introduction of competition in the distribution of electricity. Law 2000-12 introduced the regulatory authority for the electricity sector (**Autorité de Réglementation du Secteur Électrique** (ARSE)).

24 Togo, Evaluation rapide et analyse des Gaps, Juin 2012

4.3 Instruments and Institutions

4.3.1 Regulation of the Electricity Market

The regulation of local energy (including electricity) is performed through the institutions displayed in the following Table. It should be mentioned, also, that country regulators are also members of the "African Forum for Utility Regulators" - http://www.afurnet.org -. The objectives of AFUR could be broadly summarized as supporting the development of effective utility regulation in Africa through facilitating the harmonization of regulatory policies, exchange of information and lessons of experience amongst regulators, and capacity building in support of the socio-economic development of the continent.

Under the auspices of ECOWAS, the ERERA Project aimed to support the implementation of a regional regulatory authority (ECOWAS Regional Electricity Regulatory Authority - ERERA), leading to the creation of an electricity market, with a scope to improve cross-border exchanges and support the national regulators for setting international exchange tariffs. This aims to facilitate the settlement of disputes related to cross-border power exchange, enhance regional power policy, planning as well as technical regulation and integration of the regional energy sector.

Through the ERERA Project it is intended to facilitate the construction and operation of regional power generation and transmission projects which can i) optimise the use of natural resources in the region; ii) reduce the vulnerability of energy systems by sharing risks; iii) and generate economies of scale allowed by large projects. This Project was supported by AFD, the ECOWAS and the power operators of the ECOWAS Member States. (https://ec.europa.eu/europeaid/ecowas-electricity-regulation_en)

Table 9 *Regulators in the ECOWAS Countries*

Country	Institution
Benin	l'Autorité de Régulation de l'Electricité (ARE): http://www.are.bj
Burkina Faso	l'Autorité de Régulation du Sous-secteur de l'Electricité (ARSE): http://www.arse.bf
Cabo Verde	Agencia De Regulação Economica: http://www.are.cv
Cote d'Ivoire	Agence Nationale de Régulation du secteur de l'électricité: http://www.anare.ci/
The Gambia	(PURA) Gambia Public Utilities Regulatory Authority: http://www.pura.gm/
Ghana	The Energy Commission is the technical regulator of Ghana's electricity, natural gas and renewable energy industries, and the advisor to Government on energy matters: http://www.energycom.gov.gh/ The Public Utilities Regulatory Commission (PURC) regulates the provision of utility services in the electricity and water sectors and also has regulatory responsibility over charges for supply, transportation and distribution of natural gas services - http://www.purc.com.gh/
Guinea	L'ARSPEE : L'Agence de Régulation des Services Publics de l'Electricité et de l'Eau
Guinea Bissau	---
Liberia	Responsibilities described into the Electricity Law. Under establishment.
Mali	The Electricity and Water Regulatory Commission (CREE): http://www.creemali.ml/
Niger	Autorité de Régulation du Secteur de l'Energie du Niger: http://arse.gouv.net/
Nigeria	Nigerian Electricity Regulatory Commission (NERC): http://nercng.org/
Senegal	Commission de Régulation du Secteur de l'Electricité - (CRSE): http://www.crse.sn/
Sierra Leone	Sierra Leone Electricity Water Regulatory Commission (SLEWRC)
Togo	Autorité de Réglementation du Secteur de l'Electricité (ARSE): http://www.arse.tg/

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4.3.2 Organizations in Charge of Renewable Energy

Table 10 *Organizations in charge of renewable energy*

Country	Organization in charge of Renewable Energy
Benin	ANADER Agence Nationale pour le Développement des Énergies Renouvelables
Burkina Faso	Direction des Énergies Renouvelables et des Énergies Domestiques (DERED) at MME; ANEREE since 2017
Cabo Verde	Ministry of Tourism, Industry and Energy (MTIE)
Cote d'Ivoire	DMEER, Direction de la Maîtrise de l'Energie et des Énergies Renouvelables
The Gambia	Ministry of Energy
Ghana	Ministry of Power, Energy Commission and PURC
Guinea	Direction Nationale de l'Energie
Guinea Bissau	Department of Renewable Energy
Liberia	Rural and Renewable Energy Agency (RREA) linkage with LEC and MLME; manages REFUND to be created by Energy Law
Mali	Agence des Énergies Renouvelables (AER) chargée de la planification, de l'assistance technique et des investissements; Commission Nationale des Énergies Renouvelables (CER)
Niger	Direction des Énergies Renouvelables et des Énergies Domestiques (DERED) au sein du MEP
Nigeria	The Federal Ministry of Environment (FME) is in charge of sustainable development policies in Nigeria. It is involved and undertakes the development of renewable energy projects. The Federal Ministry of Water resource (FMWR) overlooks all the hydraulic resources management in the country. It is involved in the development of the hydro-power projects. The Ministry of Environment is managing the Renewable Energy Programme (REP)
Senegal	Ministère de l'Energie charge du développement des énergies renouvelables (MEDER) l'Agence nationale pour les Énergies renouvelables (ANER)
Sierra Leone	Ministry of Energy / renewable energy unit
Togo	La Direction Générale de l'Énergie assure le suivi et la promotion des ER dans le pays en coopération avec la CEET, la CEB et l'ARSE et avec le support du Ministère de l'Environnement

Table 11 *Renewable energy legal and regulatory framework*

Country	Organization in charge of Renewable Energy Framework
Benin	None
Burkina Faso	None
Cabo Verde	Renewable Energy Law in place since 2011
Cote d'Ivoire	Electricity Code of 2014 provide for RE specific promotion instruments
The Gambia	Renewable Energy Law in place since 2013
Ghana	Renewable Energy Act in place since 2011 PURC regulation on Feed-in Tariff and Capacity cap for electricity generated from renewable energy sources (12 Nov 2014)
Guinea	None
Guinea Bissau	None
Liberia	None
Mali	None
Niger	None
Nigeria	New FIT regulation adopted by NERC in 2015
Senegal	Renewable Energy Law in place since 2010 Decrees 2011-2013 & 2011-2014 on PPA conditions for RE projects
Sierra Leone	None
Togo	None

4.3.3 Organizations in Charge of Energy Efficiency

Table 12 *Organizations in charge of energy efficiency*

Country	Organization
Benin	SSPE Service Statistique Planification et Économies d'Énergie transféré de facto au DAEM (Développement de l'Accès à l'Énergie Moderne); ANADER Agence Nationale pour le Développement des Énergies Renouvelables reprend la mission Efficacité Energie de l'ABERME
Burkina Faso	La Direction de la Promotion des Économies d'Énergie (DPEE) au sein du Ministère des Mines et de l'Énergie (MME); creation of ANEREE
Cabo Verde	Ministry of Tourism, Industry and Energy (MTIE)
Cote d'Ivoire	DENR, Direction des Énergies Nouvelles et Renouvelables; IREN, Institut de Recherche sur les Énergies Nouvelles
The Gambia	Ministry of Energy
Ghana	Ministry of Power
Guinea	Direction chargée de la promotion de l'efficacité énergétique et de la lutte contre la fraude au sein d'EDG
Guinea Bissau	None
Liberia	Ministry of Energy
Mali	Direction Nationale de l'Energie (DNE), notamment à travers la Division Maîtrise de l'Energie (DME)
Niger	Direction Générale de l'Energie du Ministère de l'Energie et du Pétrole
Nigeria	Market/Energy Efficiency and Renewable Energy unit (MEER) at PTFP; National Centre for Energy Efficiency and Conservation (NCEEC) attached to the University of Lagos
Senegal	Agence des Economies et Maitrise de l'Energie AEME
Sierra Leone	Ministry of Energy / energy efficiency unit
Togo	Agence Togolaise de l'Environnement et de la Maîtrise de l'Énergie (ATEME)

4.3.4 Rural Electrification

Table 13 *Organizations in charge of rural electrification*

Country	Organization in Charge Rural Electrification
Benin	Agence Béninoise d'Electrification Rurale et de Maîtrise de l'Energie (Beninese rural electrification and energy conservation)
Burkina Faso	Fonds de Développement de l'électrification (Electrification Fund) (FDE)
Cabo Verde	Coordinated by the Ministry of Energy
Cote d'Ivoire	Direction Générale de l'Energie (DGE) CI-ENERGIES
The Gambia	Rural Electrification is conducted by the central government (see also
Ghana	Rural Electrification Fund
Guinea	Bureau de l'Electrification Rurale Décentralisée (Bureau of decentralized rural electrification) (BERD) / L'AGER: L' Agence Guinéenne d'Electrification Rurale
Guinea Bissau	None
Liberia	Rural and Renewable Energy Agency (RREA)
Mali	Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale (Malian agency for the Development of Household Energy and Rural Electrification (AMADER))
Niger	Cellule d'Electrification Rurale (Rural electrification agency)
Nigeria	Rural Electrification Agency
Senegal	Agence Sénégalaise d'Electrification Rurale (Senegalese rural electrification agency) (ASER)
Sierra Leone	There is not yet an Agency for Rural Electrification. Rural Electrification policy is conducted by the Ministry of Energy via the Rural Renewable Energy Project (RREP)
Togo	Exploratory mission is underway to create a Rural Electrification Agency

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5 Consolidation Assessment

5.1 Assumptions

1. There was variation in the current year (2010, 2013, 2014 and 2015) for several datasets and in order to harmonize the aggregation of data, **the year 2015 was selected as the current year** throughout the analysis. This means that only RE installed capacities from the years 2015 and below, were considered.
2. The EREP and the SE4ALL Action Agendas of each member state spell out RE targets for years 2020 and 2030 but these values vary in both documents. For this analysis, indicators where tagged with either the word "Actual" or "Projected". The former representing the actual targets each member state set in the Action Agendas whiles the latter depicts targets set in the EREP.
3. There is a possibility that the year of commissioning and the year completion of the construction of a power plant could vary. For the purpose of the analysis, this variation was eliminated such that years stated now simply represent year of installed capacity.
4. The values in MW were used for the analysis - as solely using the shares (%) could be misleading since an increase in conventional energy in the mix reduces the share of REs but may not necessary depict that RE capacity has declined.
5. The Business-As-Usual model assumes holding all economic variables constant; the member states will double RE installed capacity by the next set target.

5.2 Results and Analysis

The Actual RE Installed Capacity (AREIC) including Medium and Large Hydro (MLH) of 4,660 MW representing 20.71% of RE capacity in the total mix as of 2015, indicates that if member states decide to follow their Busi-ness-as-Usual (BAU) scenario, the region will double the existing capacity and exceed the Theoretical RE Installed Capacity (TREIC) target of 8,697 MW by 2020 (35%), as explained in paragraph 2.4.5.

The AREIC excluding MLH of 262 MW representing 1.49% of REs in the total mix as of 2015 is approximately 7 times lower that the TREIC target of 2,424 MW by 2020 (10%). Under the BAU scenario, the region would have attained 524 MW (262 x 2) of AREIC excluding MLH as of 2020 and this value is 14.5 times less than the TREIC target of 7,606 MW by 2030 (19%).

The actual projected RE installed capacity (APREIC) including MLH of 13,944.9 MW and 31,683.7 MW for the years 2020 and 2030 respectively far exceed the TREIC targets for corresponding years (8,697 MW and 18,946 MW). Similarly the APREIC excluding MLH 2020 (5,431.9 MW) and 2030 (22,806.7 MW) targets exceed the TREIC targets for corresponding years (2,424 MW and 7,606 MW). This vividly depicts the crucial role MLH play in the share of REs and shows the region's heavy dependence on MLH.

Indicator	Technology	Value	Unit	Description	Target Year
Theoretical Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass	8,697	MW	Theoretical projected renewable energy installed capacity (including large and medium scale hydro).	2020
Theoretical Projected Installed Capacity (Share)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass	35	%	Renewable energy share of the total theoretical installed capacity (including medium and large hydro).	2020
Theoretical Projected Installed Capacity (Number)	Wind, Solar PV, Solar CSP, Small Hydro, Medium and Large Hydro, Biomass	18,946	MW	Theoretical projected renewable energy installed capacity (including large and medium scale hydro).	2030
Theoretical Projected Installed Capacity (Share)	Wind, Solar PV, Solar CSP, Small Hydro, Medium and Large Hydro, Biomass	48	%	Renewable energy share of the total theoretical installed capacity (including medium and large hydro).	2030
Theoretical Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Biomass	2,424	MW	Theoretical projected renewable energy installed capacity (excluding large and medium scale hydro).	2020
Theoretical Projected Installed Capacity (Share)	Wind, Solar PV, Small Hydro, Biomass	10	%	Renewable energy share of the total theoretical installed capacity (excluding medium and large hydro).	2020
Theoretical Projected Installed Capacity (Number)	Wind, Solar PV, Solar CSP, Small Hydro, Biomass	7,606	MW	Theoretical projected renewable energy installed capacity (excluding large and medium scale hydro).	2030
Theoretical Projected Installed Capacity (Share)	Wind, Solar PV, Solar CSP, Small Hydro, Biomass	19	%	Renewable energy share of the total theoretical installed capacity (excluding medium and large hydro).	2030
Actual Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass	4,660	MW	Actual renewable energy installed capacity (including large and medium scale hydro).	2015
Actual Installed Capacity (Share)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass	20.71	%	Ratio of the actual RE installed capacity (including medium and large hydro) in 2015 to the total actual installed capacity from renewable and conventional energies (including large and medium scale hydro) in 2015.	2015
Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Biomass	262	MW	Actual renewable energy installed capacity (excluding large and medium scale hydro).	2015
Actual Installed Capacity (Share)	Wind, Solar PV, Small Hydro, Biomass	1.49	%	Ratio of the actual RE installed capacity (excluding medium and large hydro) in 2015 to the total actual installed capacity from renewable and conventional energies (excluding large and medium scale hydro) in 2015.	2015
Actual Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass	13,944.9	MW	Actual projected renewable energy installed capacity (including large and medium scale hydro).	2020
Actual Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass, Geothermal	31,683.7	MW	Actual projected renewable energy installed capacity (including large and medium scale hydro).	2030
Actual Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Biomass	5,431.9	MW	Actual projected renewable energy installed capacity (excluding large and medium scale hydro).	2020
Actual Projected Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Biomass, Geothermal	22,806.7	MW	Actual projected renewable energy installed capacity (excluding large and medium scale hydro).	2030
Actual Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Medium and Large Hydro, Biomass, Fossil Fuels	22,501.2	MW	Total installed capacities from all renewable and conventional energies (including large and medium scale hydro).	2015
Actual Installed Capacity (Number)	Wind, Solar PV, Small Hydro, Biomass, Fossil Fuels	17,527.8	MW	Total installed capacities from all renewable and conventional energies (excluding large and medium scale hydro).	2015

It is evident from these ambitious targets that member states intend to explore alternative sustainable pathways away from the BAU scenario. The Investment Prospectus (IP), which is an instrument developed to help member states achieving the SE4ALL goals by identifying and developing a set of implementable programmes and projects, including their investment requirements and make them visible to potential private and public investors will play a major role in the facilitating the increase of RE capacity through alternative pathways.

5.3 Constraints

1. The unavailability of data for the total installed capacities from all renewable energies plus conventional energies with and without MLH for 2020 and 2030 restricted the analysis to comparing installed capacities.
2. Countries that did not state any targets (left them blank) for some RE technologies and these were assigned zeros. This may not be the case de facto as there could be existing data but only that it is not accessible. This could have an impact on some computed values.
3. The insufficient information/data available limited the analysis to the BAU scenario.

5.4 Conclusion

1. There is a high propensity of the ECOWAS Region being able to meet its 2020 and 2030 targets when MLH is taken into consideration but unlikely to meet its targets when MLH is not taken into consideration.
2. There is heavy dependence of MLH in as an RE technology in the energy mix and this could have implications on energy security in the region if measures are not taken.
3. The BAU scenario will not be suffice in attaining the regional targets and hence alternative sustainable pathways must be sought.

5.5 Recommendations

1. Data collection and data mining techniques should be deployed in future to help close data gaps to improve the accuracy and consistency of data (data integrity) which subsequently results in high quality analysis.
2. Additionally, further research needs to be conducted to perform more robust analysis with detailed alternative RE pathways.

6 Concluding Remarks and Way Forward

The initiative which has been expressed through the Action Agendas (AA) and the corresponding Action Plans (AP) for Renewable Energy and Energy Efficiency (NREAP and NEEAP) for all the countries of the ECOWAS Region has characteristics of snapshots at given points in time. The first part of the AAs and the APs provides information on the current situation pertaining the energy sector in terms of Access to Energy, Renewable Energy and Energy Efficiency, while the second part expresses each Nation's Vision and Targets for the years to come. All countries share a common vision; to raise the development levels of the economies and improve the living standards of the people, through the energy constituent of the Development efforts.

At Regional level, ECOWAS, has expressed its vision and commitment for universal access to Energy, for the exploitation and further penetration of Renewable Energy into the Energy mix and for tapping "wasted" Energy potential through Energy Efficiency measures and policies.

By 2030 Access to Energy services should be Universal, the totality of people should have access to modern cooking, and RE should contribute largely to the energy mix.

The consolidation of the information contained in the Action Agendas and the Actions Plans, has revealed that the aggregated targets are moving to the direction of set regional goals. **The current differences, which are large in many cases between countries, and even within the same country, have become apparent, indicating areas and gaps where interventions and actions are necessary.**

In order for such actions to be efficiently implemented, at regional and national level, it appears necessary to create a common monitoring platform, which is under elaboration, within the framework of several initiatives, to be further developed and elaborated. Similar and aligned information is a fundamental constituent of this, and the Action Agendas, which have been developed within the SE4ALL initiative are an important step towards the alignment of information at technical, legislative or institutional level.

This consolidation exercise has revealed a number of issues, such as:

- Information, if available, does not always correspond to the same point in time or is provided in different manners;
- Even for "easy" information, such as existing generation capacity (conventional or Renewable), information is not always available;
- Due to the large differences existing between countries, consolidation may result to distortions when presenting aggregations. Nigeria's performance, for instance, with more than 50% of the Region's population and around 75% of the GDP, affects largely the aggregated indicators;
- There are cases with targets being quite optimistic, taking into consideration the existing conditions in certain countries. Liberia's, for instance, 100% electrification rate in 2030 seems optimistic given the current conditions and the current state of the economy;

- Similarly, the targets expressed in certain cases, seem not to have been elaborated in depth, but rather align with the regional goals;
- The state of legal and institutional arrangement is not at the same level at all countries, creating the requirement for different acceleration rates between the countries for faster adaptation to meet declared targets;
- The Electricity Law, being a policy element in all countries, specializes, to a different extent, to Renewable Energy. Almost all countries have established a Regulator, but few countries have established specialized Renewable Energy or Energy Efficiency institutions.
- In few countries Feed-in-Tariff (FIT) schemes for Renewable Energy have been established. FITs are in most countries negotiated between the IPP and the competent authority.
- Rural Electrification Agencies/Authorities, being in charge of electrification in rural areas, have been established in almost all countries, while at the same time they are the instrument conveying policies for the improvement of access to energy.

In support of the Regional Policy, the systematization of the actual and background information provides the grounds for efficient policies implementation. It can also allow to have clearer view of the actual conditions, thus enabling "to the point" actions, easier benchmarking and exchange of best practices, and more effective customization of policies to local needs. The step following the Action Agendas, the Investment Prospectus, which aims to link Vision with Actions (i.e. projects) allows to acquire and establish an understanding of whether expressed vision thinking is met with, or supported by actions.

This first round of Action Plans for Energy Access, Renewable Energy and Energy Efficiency has showcased that leaning information and monitoring on a continuous basis has the potential to support policy implementation either at broader or at targeted level. This way it should be seen and continued.

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Appendix

Annex 1
National Focal Institutions

Country	Institution and Contact
Benin	Direction Générale de l'Energie Ministère de l'Energie et de l'Eau 06 BP 2049 Cotonou benin@ecreee.org
Burkina Faso	Ministere des Mines, et de l'Energie 01 B.P. 644, Ouagadougou 01 burkinafaso@ecreee.org
Cabo Verde	Direção Geral da Energie Rua Cidade do Funchal, No.2, Achada Santo Antonio, CP 15, Ilha do Santiago caboverde@ecreee.org
Cote D'Ivoire	Direction Generale de l'Energie 01 BP 2541 Abidjan 01 cotedivoire@ecreee.org
The Gambia	Gambia Renewable Energy Centre (GREC) Ministry of Energy TK Motors Rd, Kanifing gambia@ecreee.org
Ghana	Energy Commission Spintex Road, PMB, Ministries Post Office, Accra ghana@ecreee.org
Guinee	Direction Nationale BP 1217 Conakry guinee@ecreee.org
Guinee-Bissau	Secretaria de estado da Energia/Direcção Geral de Energia B.P 311 Bissau guineebissau@ecreee.org
Liberia	Rural and Renewable Energy Agency LEC Sub-station, New Port Street, Monrovia Liberia liberia@ecreee.org
Mali	Direction Nationale de l'Energie (DNE) Plateau de Badalabougou, complexe de l'ex-CRES, Bamako, BP: 1872 mali@ecreee.org
Niger	Direction des Energies Renouvelables et des Energies Domestique (DERED), Ministere de l'Energie et du Petrole, B.P 11700, Niamey, Niger niger@ecreee.org
Nigeria	Federal Ministry of Power 3rd Floor, Federal Secretariat, Shehu Shagari Way, PMB 278, FCT Abuja nigeria@ecreee.org
Senegal	Direction des Energies Ministère de l'Energie et des Mines BP: 4021 Dakar senegal@ecreee.org
Sierra Leone	Ministry of Energy & Water Resources Electricity House 36 Siaka Stevens Street Freetown sierraleone@ecreee.org
Togo	Direction Générale de l'Energie / DGE Lomé togo@ecreee.org

Annex 2

Renewable Energy Targets by Country and by Technology (Source: Country NREAPs)

Renewable Energy by type	Benin			Burkina Faso			Cabo Verde		
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Small hydro (up to 30 MW)*	1	9	78	32	35	100	0	0	0
Medium and large hydro (MLH)	0	275	387	0	0	0	0	0	0
Solar (PV)	0	50	228	0	107	205	8	0	0
Tide, wave, ocean	0	0	0	0	0	0	0	0	0
Wind	0	20	40	0	0	0	26	0	0
Bioenergy	0	40	110	0	8	13	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0
Total	**1**	**394**	**843**	**32**	**150**	**318**	**34**	**150**	**225**

Renewable Energy by type	Cote d'Ivoire			Gambia			Ghana		
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Small hydro (up to 30 MW)*	55	65	131	0	0	0	0	0	0
Medium and large hydro (MLH)	549	975	1,592	0	15	44	1,580	1,580	0
Solar (PV)	0	25	424	0	17	50	3	218	0
Tide, wave, ocean	0	0	0	0	0	0	0	10	0
Wind	0	0	0	1	7	20	0	20	0
Bioenergy	0	225	485	0	0	0	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0
Total	**604**	**1,290**	**2,632**	**1**	**39**	**114**	**1,583**	**1,828**	**0**

Renewable Energy by type	Guinea			Guinea Bissau					Liberia
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Small hydro (up to 30 MW)*	0	0	0	0	0	27	0	46	91
Medium and large hydro (MLH)	0	0	0	0	0	0	0	46	91
Solar (PV)	0	0	0	11	29	59	0	0	0
Tide, wave, ocean	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	2	2	0	0	0
Bioenergy	0	0	0	0	2	2	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**11**	**32**	**89**	**0**	**46**	**91**

Renewable Energy by type	Mali			Niger			Nigeria		
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Small hydro (up to 30 MW)*	33	49	107	0	0	0	60	1.607	8.174
Medium and large hydro (MLH)	150	287	731	0	130	130	1.938	4,549	4,627
Solar (PV)	0	238	528	0	75	150	15	1,343	6.831
Tide, wave, ocean	0	0	0	0	0	0	0	0	0
Wind	0	0	20	0	0	0	10	57	292
Bioenergy	0	5	30	0	0	0	0	631	3.211
Geothermal	0	0	0	0	0	0	0	0	0
	183	**578**	**1,416**	**0**	**205**	**280**	**2.023**	**8,188**	**23,135**

Renewable Energy by type	Senegal			Sierra Leone			Togo		
	2010	2020	2030	2010	2020	2030	2010	2020	2030
Small hydro (up to 30 MW)*	0	0	0	6	42	126	2	22	70
Medium and large hydro (MLH)	66	81	225	50	510	935	65	65	115
Solar (PV)	0	172	257	0	73	95	0	45	68
Tide, wave, ocean	0	0	0	0	0	0	0	0	0
Wind	0	150	150	0	2	5	0	0	24
Bioenergy	0	0	0	0	32	68	0	0	0
Geothermal	0	0	0	0	0	0	0	0	0
Total	**66**	**403**	**632**	**56**	**659**	**1.229**	**67**	**132**	**276**

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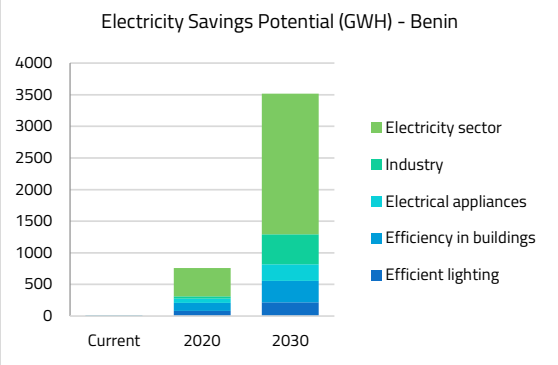
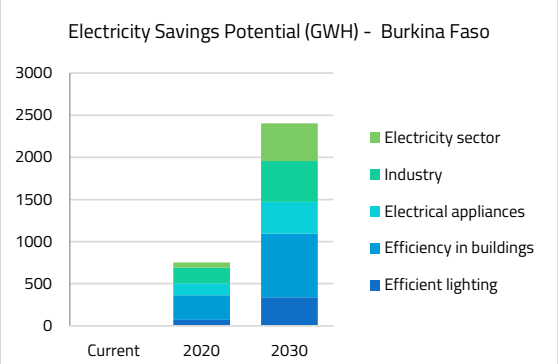
Annex 3
Expected Electricity Savings for different sectors



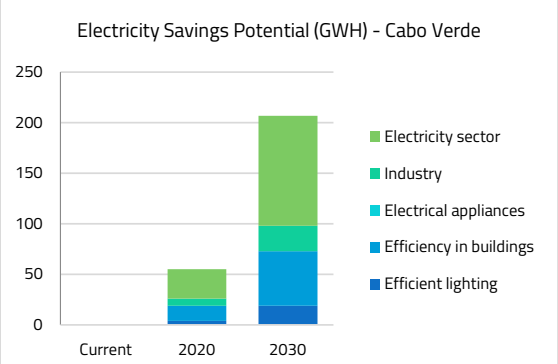
Benin

	Current	2020	2030
Efficient lighting	6.5	79.8	216.9
Efficiency in buildings	0	126.7	336.7
Electrical appliances	5	68.1	265.9
Industry	0	36	472
Electricity sector	0	448	2,226
	11.5	**758.6**	**3,517.5**



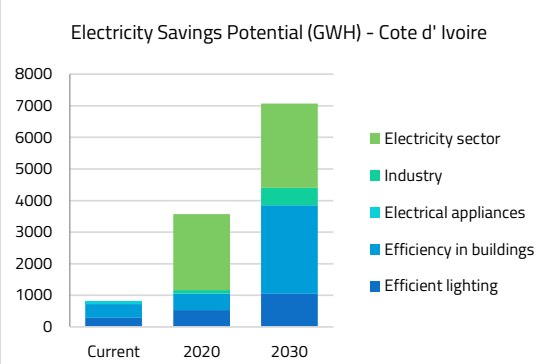
Burkina Faso

	Current	2020	2030
Efficient lighting	0	69	339
Efficiency in buildings	0	292	756
Electrical appliances	0	145	377
Industry	0	187	486
Electricity sector	0	61	447
	0	**754**	**2,405**



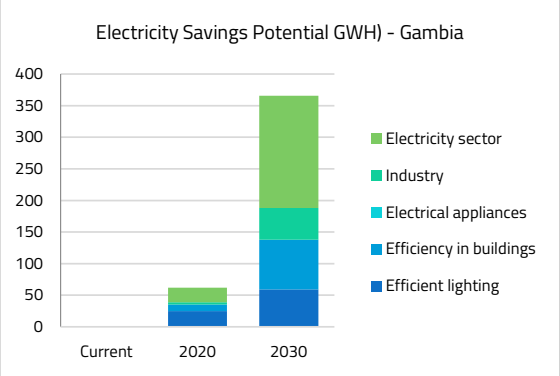
Cabo Verde

	Current	2020	2030
Efficient lighting	0	4	19
Efficiency in buildings	0	15	54
Electrical appliances	0	0	0
Industry	0	7	25
Electricity sector	0	29	109
	0	**55**	**207**



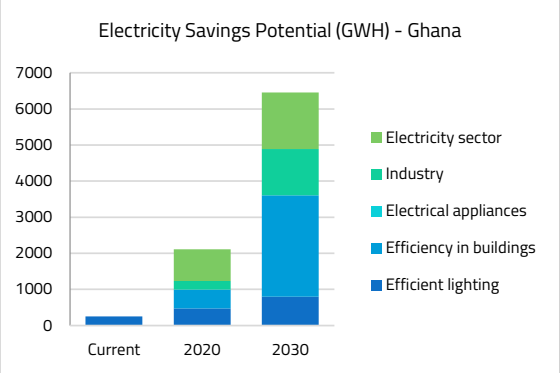
Cote d'Ivoire

	Current	2020	2030
Efficient lighting	288	528	1,044
Efficiency in buildings	432	527	2,804
Electrical appliances	84	0	0
Industry	0	114	558
Electricity sector	0	4,810	5,334
	804	**5,979**	**9,740**



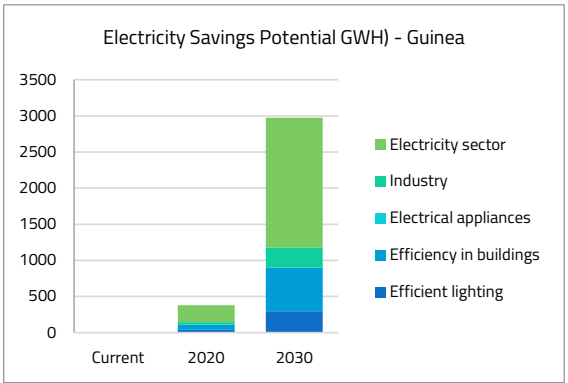
The Gambia

	Current	2020	2030
Efficient lighting	0	25	59
Efficiency in buildings	0	10	79
Electrical appliances	0	0	0
Industry	0	4	50
Electricity sector	0	22.8	177.7
	0	**61.8**	**365.7**



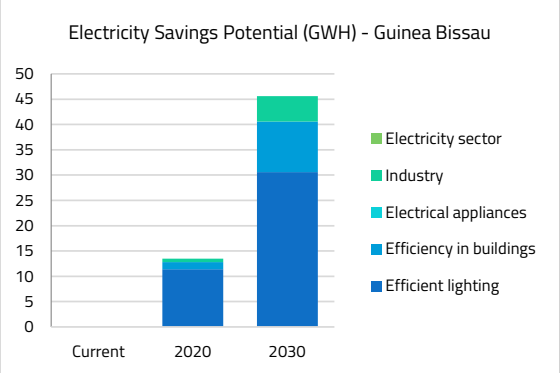
Ghana

	Current	2020	2030
Efficient lighting	250	475	798
Efficiency in buildings	0	522	2806
Electrical appliances	0	0	0
Industry	0	239	1,283
Electricity sector	0	877.5	1,571.5
	250	**2,113.5**	**6,458.5**



Guinea

	Current	2020	2030
Efficient lighting	0	38	295
Efficiency in buildings	0	73	605
Electrical appliances	0	0	0
Industry	0	33	277
Electricity sector	0	234	1,798
	0	**378**	**2,975**



Guinea Bissau

	Current	2020	2030
Efficient lighting	0	11.4	30.6
Efficiency in buildings	0	1.4	10
Electrical appliances	0	0	0
Industry	0	0.7	5
Electricity sector	0	0	0
	0	**13.5**	**45.6**

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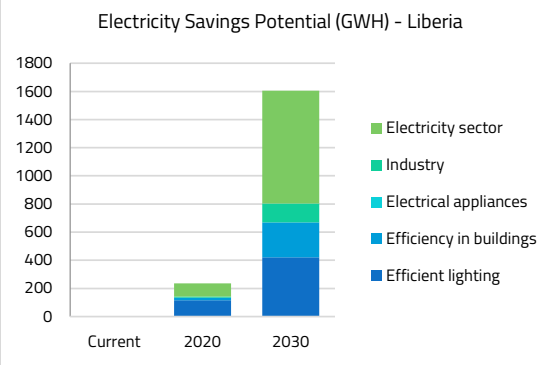
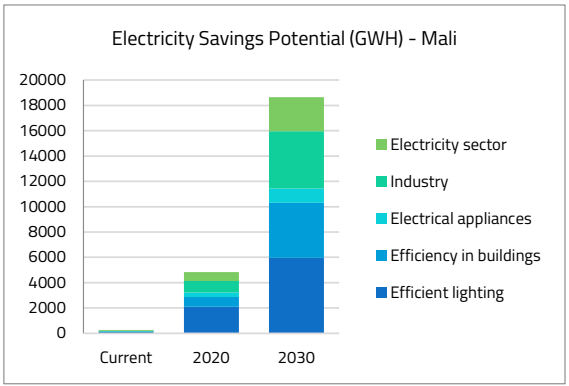


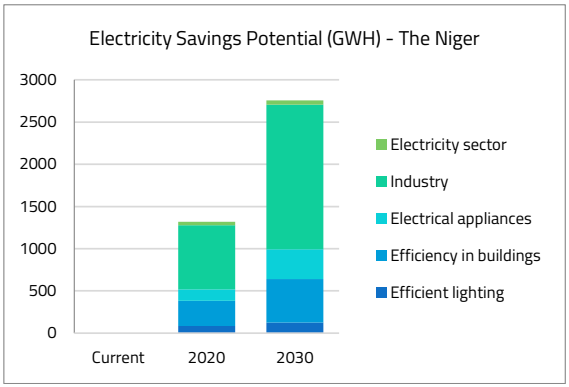
Liberia

	Current	2020	2030
Efficient lighting	0	116	420
Efficiency in buildings	0	17	250
Electrical appliances	0	0	0
Industry	0	9.8	133.5
Electricity sector	0	92	801
	0	**234.8**	**1,604.5**



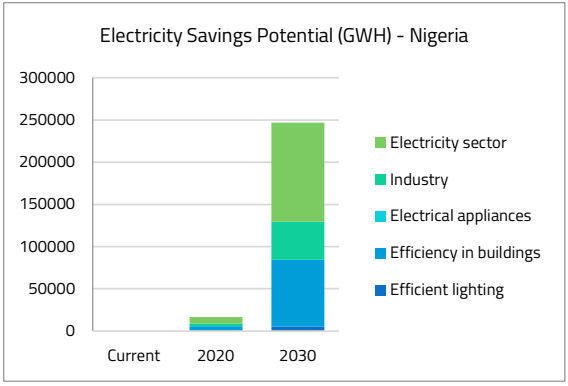
Mali

	Current	2020	2030
Efficient lighting	122	2110	5,958
Efficiency in buildings	4.91	753.3	4,356.6
Electrical appliances	24.7	370.8	1,127.4
Industry	52.3	890	4,518
Electricity sector	72	719.7	2,687
	275.9	**4,843.9**	**18,647**



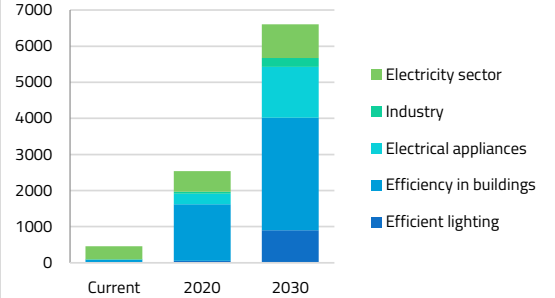
Niger

	Current	2020	2030
Efficient lighting	0	85.3	126
Efficiency in buildings	0	298	516
Electrical appliances	0	135	351
Industry	0	761	1,713
Electricity sector	0	38	52
	0	**1,317.3**	**2,758**



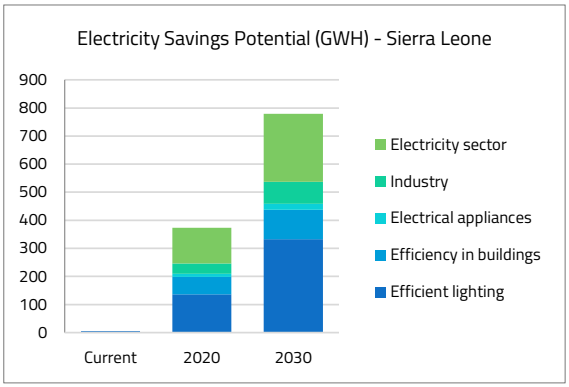
Nigeria

	Current	2020	2030
Efficient lighting	0	748	5495
Efficiency in buildings	0	5,026	78,922
Electrical appliances	0	0	0
Industry	0	2,872	45,099
Electricity sector	0	8,001	117,256
	0	**16,647**	**246,772**



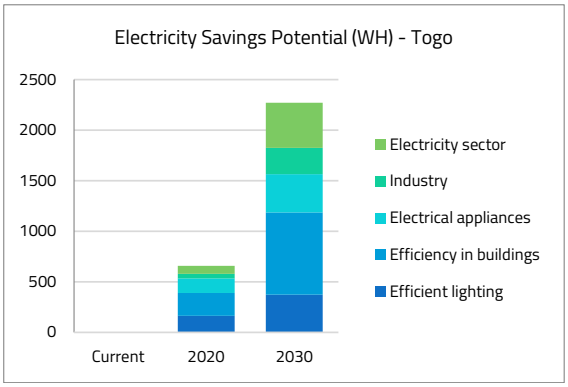
Senegal

	Current	2020	2030
Efficient lighting	2.12	50.7	901
Efficiency in buildings	81.3	1,570.8	3,115.5
Electrical appliances	4.6	290.8	1,411.3
Industry	8.4	59.5	244.1
Electricity sector	357.5	568.7	935.4
	454.0	**2,540.7**	**6,607.4**



Sierra Leone

	Current	2020	2030
Efficient lighting	5.1	136	333
Efficiency in buildings	0	62.4	104
Electrical appliances	0	11.3	22
Industry	0	36	78
Electricity sector	0	128	242
	5.1	**373.7**	**779**



Togo

	Current	2020	2030
Efficient lighting	0	163.8	373
Efficiency in buildings	0	226	815
Electrical appliances	0	145	377
Industry	0	43	261
Electricity sector	0	81.4	447.4
	0	**659.2**	**2,273.4**

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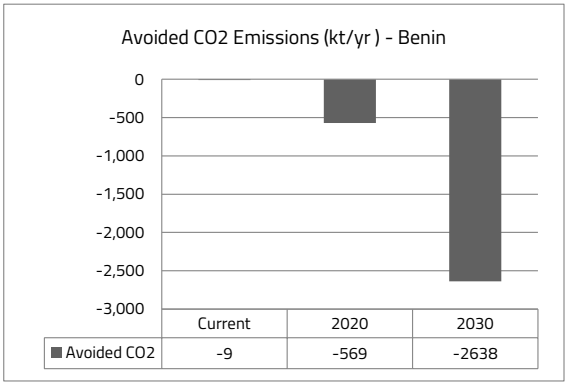
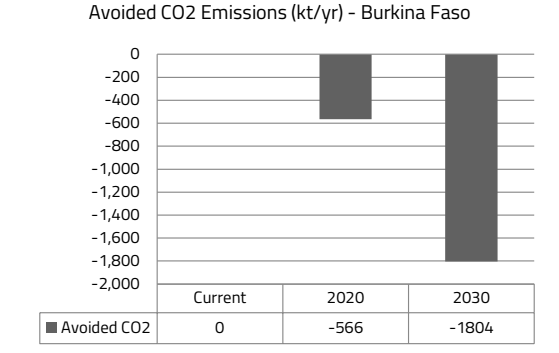
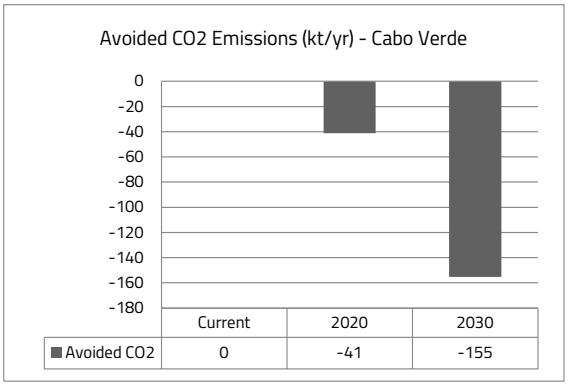
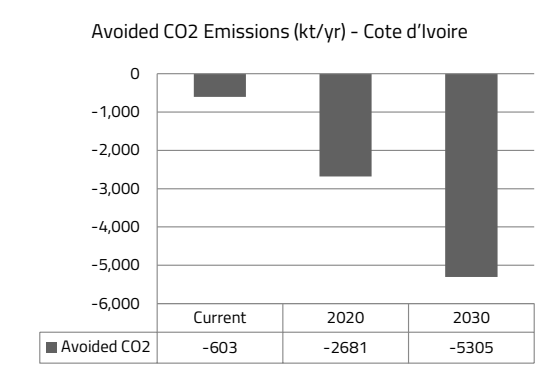
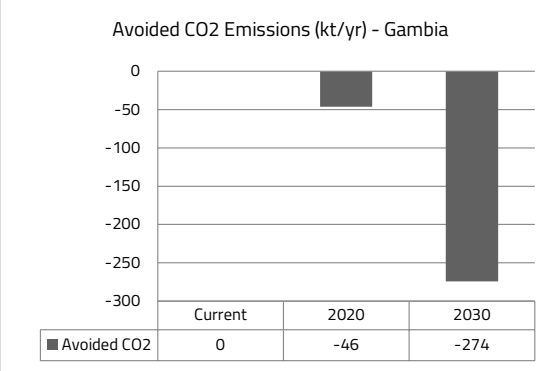
Annex 4
Expected avoided CO2 emissions attributed to Electricity Savings

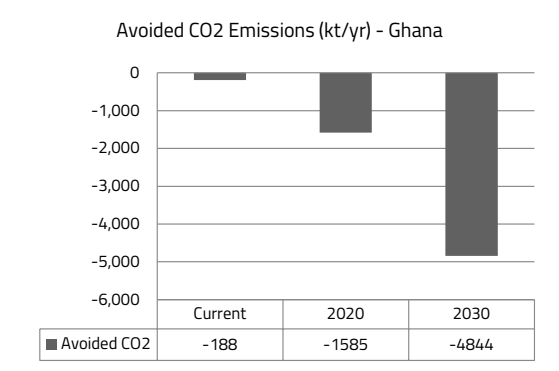


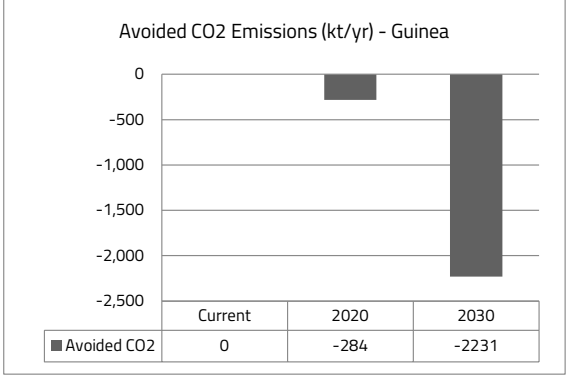


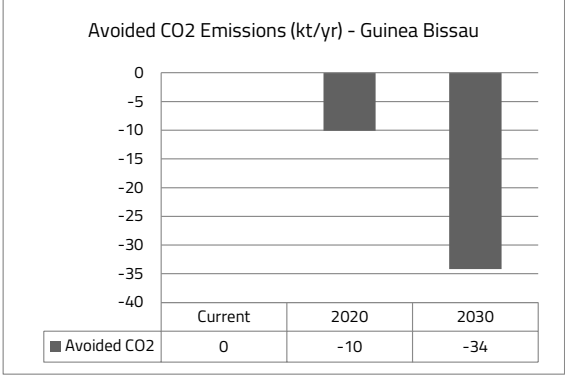


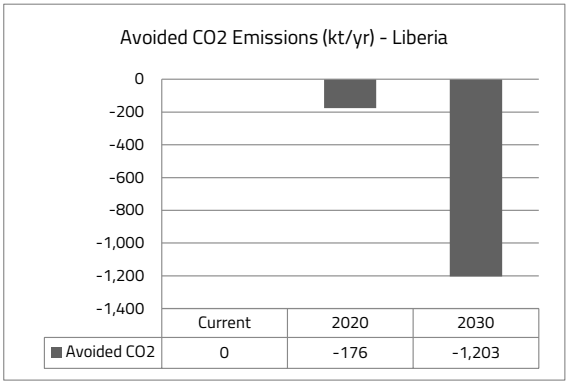


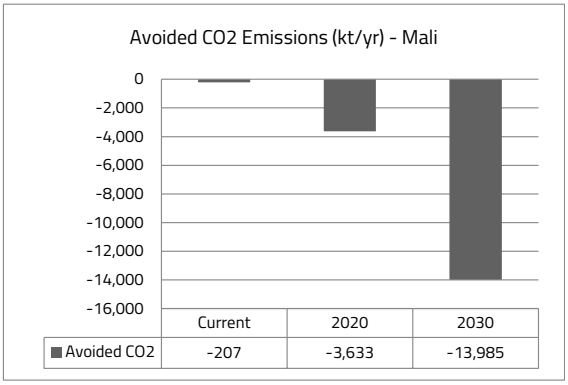


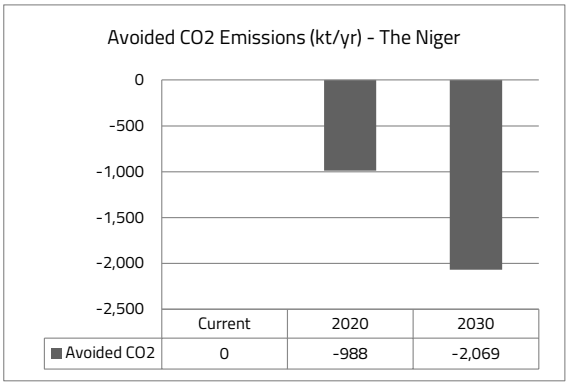


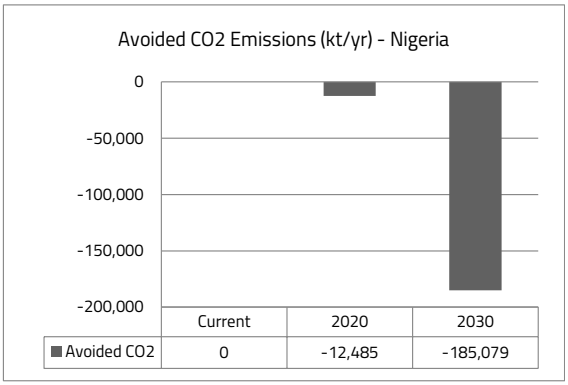


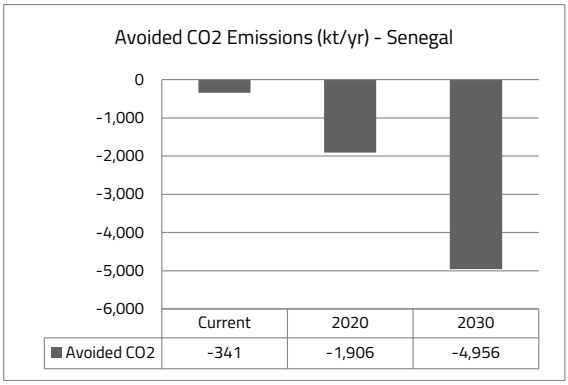


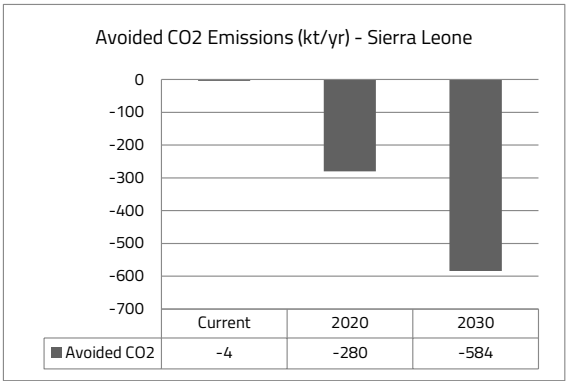

Avoided CO2 Emissions (kt/yr) - Liberia
0
-200
-400
-600
-800
-1,000
-1,200
-1,400
Current
2020
2030
Avoided CO2
0
-176
-1,203

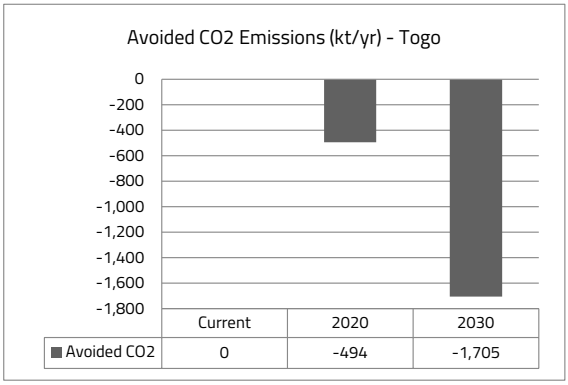

Avoided CO2 Emissions (kt/yr) - Mali
0
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
-14,000
-16,000
Current
2020
2030
Avoided CO2
-207
-3,633
-13,985


Avoided CO2 Emissions (kt/yr) - The Niger
0
-500
-1,000
-1,500
-2,000
-2,500
Current
2020
2030
Avoided CO2
0
-988
-2,069


Avoided CO2 Emissions (kt/yr) - Nigeria
0
-50,000
-100,000
-150,000
-200,000
Current
2020
2030
Avoided CO2
0
-12,485
-185,079


Avoided CO2 Emissions (kt/yr) - Senegal
0
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
Current
2020
2030
Avoided CO2
-341
-1,906
-4,956


Avoided CO2 Emissions (kt/yr) - Sierra Leone
0
-100
-200
-300
-400
-500
-600
-700
Current
2020
2030
Avoided CO2
-4
-280
-584


Avoided CO2 Emissions (kt/yr) - Togo
0
-200
-400
-600
-800
-1,000
-1,200
-1,400
-1,600
-1,800
Current
2020
2030
Avoided CO2
0
-494
-1,705

ECREEE
TOWARDS SUSTAINABLE ENERGY

From Vision to Coordinated Action

Consolidation of SE4ALL Action Agendas, National Renewable Energy Action Plans, and National Energy Efficiency Action Plans of the ECOWAS region countries

September 2017

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