

Annex: The Case of Benin

Baseline Assessment Report

Photo: Ganvie, a lake village in Benin, lying in Lake Nokoué, near Cotonou



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List of Acronyms

ABERME	Agence Béninoise d'Électrification Rurale et de Maitrise d'Énergie (<i>Beninese Agency for Rural Electrification and Energy Management</i>)
ABREC	African Biofuel and Renewable Energy Company
AfDB	African Development Bank
ADB	The Arab Development Bank
AFD	Agence Française de Développement (<i>French Development Agency</i>)
ANADER	Agence Nationale des Energie Renouvelables (<i>National Agency for the Development of Renewable Energy</i>)
ANCB	Association Nationale des communes du Bénin (<i>National Association of Municipalities of Benin</i>)
ARE	Autorité de Régulation de l'Énergie (<i>Energy Regulatory Authority</i>)
AU	African Union
BADEA	The Arab Bank for Economic Development in Africa
BEP	Benin Energy Plus project
BOT	Build-Operate-Transfer (PPP)
CAA	Caisse Autonome d'Amortissement (<i>Autonomous Amortization Fund</i>)
CAPPP	Cellule d'appui aux PPP (<i>Public-Private Partnership Support Unit</i>)
CDP	Communal Development Plan
CDM	Clean Development Mechanism
CEB	Communauté Électrique du Bénin (<i>Electricity Community of Benin</i>)
CONTRELEC	Agence de Contrôle des installations Électriques intérieures (<i>Agency for the Control of Internal Electrical Installations</i>)
CSP	Concentrated solar power plant
DAEM	Plan directeur de développement du sous-secteur de l'énergie électrique au Bénin (<i>Electricity Sub-sector Development Master Plan</i>)
DENR	Direction des Énergies Nouvelles et Renouvelables (<i>Directorate of New and Renewable Energy</i>)
DFI	Development finance institutions
DGRE	Direction Générale des Ressources Énergétiques (<i>Directorate General of Energy Resources</i>)
ECOWAS	Economic Community of West Africa States
ECREE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EDD	Électricité de Djibouti (<i>Djibouti Electricity</i>)
EIB	European Investment Bank
ERERA	Autorité de Régulation Régionale du Secteur de l'Électricité de la Cedeao (<i>Regional Electricity Regulatory Authority</i>)
FER	Fonds d'électrification rurale (<i>Rural Electrification Fund</i>)
GAP	Government Action Programme
GDP	Gross domestic product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (<i>German Development Agency</i>)
GoB	Government of Benin
GTI	Global tilted irradiation
GWh	Gigawatt hour (1 GWh = 1,000,000 kWh)
IDB	Islamic Development Bank
INDCs	Intended Nationally Determined Contributions
IRENA	International Renewable Energy Agency

IPP	Independent Power Producer
ISA	International Solar Alliance
Ktoe	Kiloton of oil equivalent
KfW	Kreditanstalt für Wiederaufbau
kWh	Kilowatt hour
LNG	Liquefied natural gas
MASEN	Moroccan Agency for Sustainable Energy
MCC	Millennium Challenge Corporation
MCVDD	Ministère du Cadre de Vie et du Développement Durable (<i>Ministry of Sustainable Development and Quality of life</i>)
MDB	Multilateral development bank
MEF	Ministère de l'Économie et des Finances (<i>Ministry of Economy and Finance</i>)
MERPMEDER	Ministère de l'Énergie, des Recherches Pétrolières et Minières, de l'Eau et du Développement des Energies Renouvelables (<i>Ministry of Energy, Petroleum and Mining Research, Water and Development of Renewable Energies</i>)
MPD	Ministère du Plan et du Développement (<i>Ministry of Development and Planning</i>)
MOU	Memorandum of Understanding
MW	Megawatt (1 MW = 1 000 kW)
PANER	Plan d'Action National des Energies Renouvelables (<i>National Renewable Energy Action Plan</i>)
PEUN	Programme Énergétique d'Urgence National (<i>Energy Emergency National Programme</i>)
PONADER	Politique Nationale de Développement des Énergies Renouvelables (<i>National Policy for the Development of Renewable Energy</i>)
PRODERE	Programme Régional du Développement des Énergies Renouvelables et Efficacité Énergétique (<i>Regional Programme for the Development of Renewable Energy and Energy Efficiency</i>)
PPP	Public-private partnership
PV	Photovoltaics
RE	Renewable energy
SBEE	Société Béninoise d'Énergie Électrique (<i>Beninese Electricity Company</i>)
SBPE	Société Béninoise de Production d'Électricité (<i>Beninese Electricity Production Company</i>)
TAP	Transformative Actions Program
TFP	Technical and Financial Partners
UNCDF	UN Capital Development Fund
USAID	US Agency for International Development
VAT	Value Added Tax
WAPP	West African Power Pool
WAEMU	West African Economic and Monetary Union
WSP	Water and Sanitation Programme

1 Introduction

1.1 Benin Energy Plus Project

The objective the Benin Energy Plus (BEP) Project is to investigate tools that can bridge the financing gaps for clean energy access in communities. Public-private partnerships (PPPs) and the use of carbon credits have been identified as key mechanisms to enabling energy access projects in Benin. The BEP project further aims to build the capacities of relevant local stakeholders to utilise these tools, through the development of a PPP toolkit and relevant training resources.

Key project outputs and deliverables

Key deliverables for the BEP project include the following work packages:

1. Baseline assessment (this report);
2. Development of PPP Toolkit to implement energy access (Solar PV) project with carbon credit considerations;
3. Testing and validation of PPP Toolkit; and
4. Capacity building and dissemination of PPP Toolkit

The following key project activities have been identified for the baseline assessment work package and are accordingly included in this report:

- a) Assessment of energy access status-quo in Benin, including mapping of key stakeholders and identifying barriers to implementation of energy access projects.
- b) Identification of potential policies and measures, as well as assessing the suitable policy instruments for solar PV PPP in Benin.
- c) Dialogue with key stakeholders and initial findings, with the aim to enhance energy access through solar PV.
- d) Assessment of the potential of the carbon market, and opportunities for carbon credits and demand (off-sets) in Benin.

1.2 Introduction to Benin

Benin is a developing country in West Africa. A majority of the population lives on the Bight of Benin, the small coastline to the south of the country. It covers an area of 114,763 km², with a population of about 10.88 million. In 2018, 47% of the population was living in urban areas¹, and the future projects by Benin's National Institute of Statistics and Economic Analysis predicted that approximately 60% of the population will live in cities by 2025, mainly located in the coastal areas². Benin is thus experiencing rapid urbanisation coming concurrently from natural increase and rural migration, creating an increasing pressure on service deliveries to the urban population.

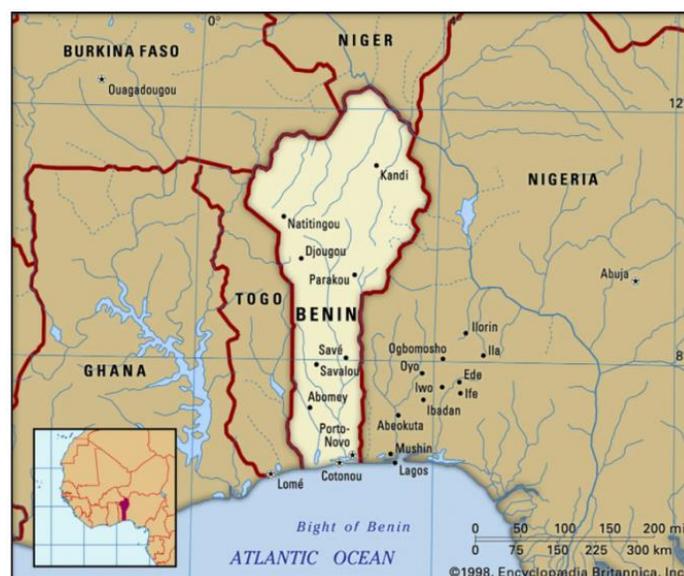


Figure 1: Benin's location in West Africa

At the regional and continental levels, Benin is part of several economic and political organisations, such as the African Union (AU), the West African Economic and Monetary Union (WAEMU), and the Economic Community of West African States (ECOWAS). Benin is politically stable and has been a democracy since 1990, with a decentralized system of governance. The country benefits from a stable socio-political environment that is conducive to business and development³. It nevertheless ranked 163 of 188 countries on the 2017 Human Development Index⁴. National poverty rates increased from 37.5% in 2006 to 40.1% in 2015, but decreased to 38.5% in 2019⁵. Higher poverty rates exist in rural areas compared to urban areas⁶. Benin is indeed characterised by an imbalance between demographic and economic growth, resulting in the development of an increasingly poor population.

¹http://french.xinhuanet.com/2019-11/08/c_138540459.htm#:~:text=Au%20cours%20du%20premier%20Forum,%C3%A9tait%20de%2047%25%20en%202018.

² <https://www.britannica.com/place/Benin>

³ Plan Stratégique du ministère de l'énergie 2020-2024, p.16.

⁴ United Nations Development Programme. 2018. Human Development Indices and Indicators: 2018 Statistical Update. http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf

⁵ https://databankfiles.worldbank.org/data/download/poverty/987B9C90-CB9F-4D93-AE8C-750588BF00QA/previous/Global_POVEQ_BEN.pdf

⁶ Institut national de la statistique et de l'analyse économique. Cinquième recensement général de la population et de l'habitat. Note: At the time of writing, the document was still in the validation process and was not yet available online.

Benin is divided into 12 departments and subdivided into 77 communes, which, in turn, are divided into districts (*arrondissements*) and finally into villages or city districts. All communes are required to draw up and adopt a Communal Development Plan (CDP) and ensure its execution in harmony with national guidelines (Law 2021-14 of 20 December 2021)⁷.

Benin's real gross domestic product (GDP) growth was estimated to have slowed to 2.3% in 2020, after reaching 6.9% in 2019 and 6.7% in 2018. The slowdown in growth on the supply side reflects the underperformance of commerce, transport, agriculture, and hotels and restaurants—the sectors most affected by the COVID-19 pandemic⁸. Benin's external debt accounts for 55.5% of total debt in 2020—56% of which is owed to multilateral lenders (mostly on concessional terms), 12.7% is bilateral, 17% is commercial, and 14.2% is in Eurobonds⁹.

More than half of Benin's population (55.4%) live in rural areas and practice agriculture. The agricultural sector, therefore, plays an essential role in the Beninese economy, accounting for more than 70% of the active population and contributing more than 37% of the country's GDP¹⁰.

The main environmental issues in the country are desertification, deforestation, wildlife endangerment, and water pollution. Regular droughts accelerate the spread of the desert into agricultural lands in the north. Benin has also lost 59% of its forests from uncontrolled agricultural practices and fires. Between 2001 and 2021, forest and woodland were reduced by 25%, corresponding to a 2.2% annual decrease¹¹.

In 2018, Benin was reported to be one of the most vulnerable countries to climate change in the world¹². The need for energy access, specifically in rural Benin, as well as the climate risk combined with the potential debt risk, underline the importance of implementing local renewable energy options that can be implemented through PPPs. Hence, the BEP project aims to support the growth of energy access through solar PV, specifically addressing the core needs of rural Benin, while addressing climate change impact through both mitigation and adaptation.

⁷ <https://docs.wfp.org/api/documents/WFP-0000104700/download/>

⁸ <https://www.afdb.org/en/countries-west-africa-benin/benin-economic-outlook>

⁹ https://www.afdb.org/sites/default/files/2021/03/12/aeo-2021-country_notes-en.pdf

¹⁰ Politique Nationale de Développement des Énergies Renouvelables (PONADER) - 2020

¹¹ <https://bit.ly/3ycGG9A>

¹² Benin is ranked 155th of 181 countries. <https://adaptation-undp.org/projects/benin-nap-process>
<https://docs.wfp.org/api/documents/WFP-0000104700/download/>

2 Overview of Benin's emissions and status of energy access

This section provides an overview of Benin's emissions and status of energy access, including the following:

- Analysis and description of key stakeholders
- Inventory and description of existing instruments / measures in Benin
- Identification of regulatory and financial barriers in Benin (to contain information on analysis of Benin's energy framework, including main sources and barriers to use renewable energy (RE) with a special focus on solar PV instruments/measures in Benin)

2.1 Analysis and description of key stakeholders

Key stakeholders in Benin include the state actors, technical and financial partners, as well as the public establishment. However, because Benin is a small country within the region, the broader ECOWAS position needs to be taken into consideration as well.

2.1.1 Associations for Communes of Benin (ANCB)

The National Association of Municipalities of Benin acts as intermediary between municipalities and decentralisation actors in Benin.

2.1.2 Benin state actors

2.1.1.1 Benin state actors in the energy sector

The main state actors in the energy and electricity sectors include the Ministère de l'Energie, des Recherches Pétrolières et Minières, de l'Eau et du Développement des Énergies Renouvelables – Ministry of Energy.

The Ministry of Energy oversees state policy and programmatic documents in the energy sector. It is responsible for providing reliable energy to all the country's economic and social sectors in sufficient quantity and of adequate quality, for the national energy policy and coordination of the activities in the energy sector in five main areas of competences which are electricity, renewable energies, rural electrification, fossil fuels and energy efficiency.

According to the provisions of Article 3 of Decree No. 2018-072¹³ of 12 March 2018, the Ministry of Energy is responsible for developing and ensuring the implementation of the government's policy in the field of energy, in accordance with the laws and regulations of the country. According to this article, its missions include:

- defining and implementing energy policy and regulations;
- ensuring the availability of fuel supply channels and the operation of electricity production facilities;
- developing governance strategies for the sector; developing the strategic plan for the storage and supply of petroleum products;
- developing the policy for the development, increased use and accessibility of renewable energy; contributing to the mobilisation of funding for the implementation of energy policies, plans, programmes and projects;
- promoting and developing national energy resources in all sectors of activity;
- drawing up draft legislative and regulatory texts relating to energy and ensuring their application;
- providing assistance and advice to the various public service contracting authorities.

¹³ Available at: <http://are.bj/wp-content/uploads/2018/06/DECRET-PORTANT-AOF-MINISTERE-ENERGIE-2018.pdf>

Within the Ministry of Energy, several structures have a significant role as presented in Figure 2 below.

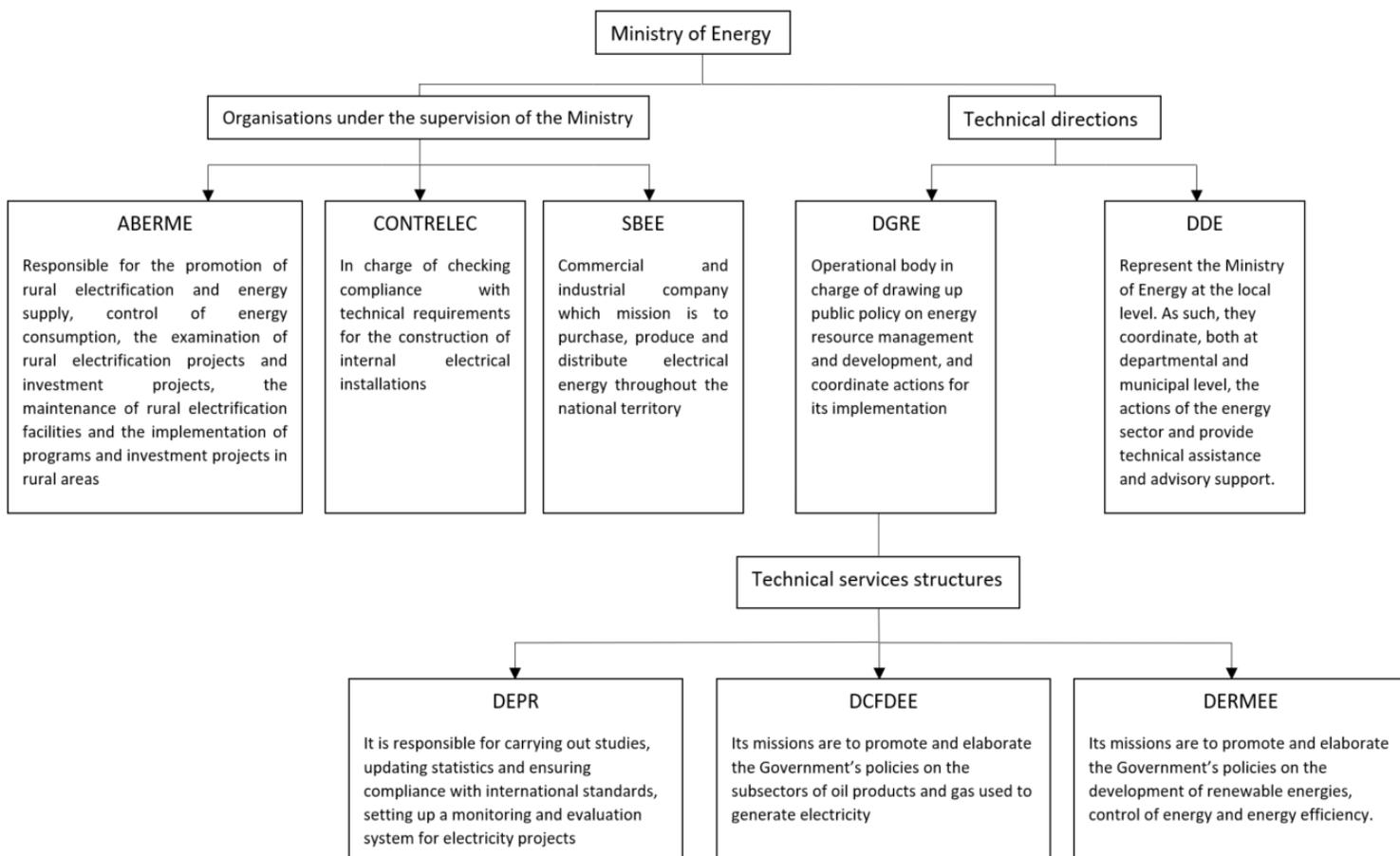


Figure 2: Structure of the Ministry of Energy¹⁴

*Note: The abbreviations refer respectively to the Agence Béninoise d'Électrification Rurale et de Maîtrise d'Énergie (ABERME) - Beninese Agency for Rural Electrification and Energy Management; the Agence de Contrôle des installations Electriques intérieures (CONTRELEC) - Agency for the Control of Internal Electrical Installations; the Société Béninoise d'Énergie Électrique (SBEE) - Beninese Electricity Company; the Direction Générale des Ressources Énergétiques (DGRE) - Directorate General of Energy Resources; the DDE the Department of Studies, * Planning and Regulation (Direction des Etudes, de la Planification et de la Réglementation - DEPR); The Department of Renewable Energies, Energy Control and Efficiency (Direction des Energies Renouvelables, de la Maîtrise et de l'Efficacité Énergétique - DERMEE); The Directorate of Fossil Fuels and Electric Power Development (DCFDEE)*

Furthermore, the Government of Benin (GoB) is currently setting up the Beninese Electricity Production Company (*Société Béninoise de Production d'Électricité; SBPE*). Created in December 2020, SBPE is a state-owned company focusing on the production of electricity, the purchase of solar energy produced by private operators, and the sale of electricity (with the Société Béninoise d'Énergie Électrique (SBEE) focusing on distribution), and the development of renewable energy production.

¹⁴ The organigram has been adapted by the author based on the organigram of the Ministry of Energy (<https://energie.gouv.bj/page/organigramme-du-ministere-de-lenergie>) and the organigram of the DGRE (<https://direction-energie.gouv.bj/apropos/organigramme.html>)

Beside the Ministry of Energy, several other national organisations have a significant role in the energy sector as shown below:

Name of the organisation	Mandate / Mission
<p>Agence Nationale des Énergies Renouvelables (ANADER) - National Agency for the Development of Renewable Energy</p>	<p>Beside the DERMEE of the Ministry of Energy, the ANADER is the main national actor regarding renewable energy. Its main mission is to facilitate the effective promotion and accelerate the development of renewable energy in Benin to meet its energy needs. It has the task, among other things, of setting the rules governing the renewable energy sector in Benin. Besides, the ANADER aims at ensuring universal access to energy services and energy management in all sectors of activity. The ANADER is also playing a role in terms of rural electrification alongside the ABERME, specifically for decentralised systems.</p>
<p>Autorité de Régulation de l'Énergie (ARE) - Energy Regulatory Authority</p>	<p>ARE was created in February 2015 and acts as the energy regulator. As such, it oversees and monitors the implementation of laws, decrees and all forms of regulation governing the energy sector. It decides on all requests for private investment, operation and supply of off-grid energy in Benin¹⁵ alongside the Ministry of Energy. The license for an electricity producer is attributed by the Ministry after the assent of the ARE.</p>
<p>Communauté Électrique du Benin (CEB) - Electricity Community of Benin</p>	<p>CEB is a bipartite utility supplying electricity to national distribution utilities in Benin and Togo (around 85% of generation capacity). It is governed by an International Agreement instituting the Benin-Togo Electricity Code signed on 27 July 1968. It has exclusive rights to undertake energy transmission activities and import electric power from neighbouring countries. Consequently, CEB is the sole entity authorized to buy electric power from the regional electricity market to meet the needs of the two countries. The energy supplied by the CEB from the Akosombo dam in Ghana and the Nangbéto dam in Togo is imported and sold to customers.</p>

¹⁵ <https://are.bj/>

To summarise, regarding the energy sector at the national level and with regard to the BEP project, there are seven key actors:

1. The **Ministry of Energy** is in charge of the energy sector in general;
2. **ABERME** is responsible for rural electrification and energy supply;
3. **CEB** handles production, transport (has a monopoly), distribution and importation of electricity in both Togo and Benin;
4. **SBEE** handles distribution (sale of electricity to the consumer);
5. **SBPE** (currently being setting up) handles production and sale of electricity, as well as purchase of electricity from solar energy from IPPs
6. **ANADER** is in charge of promoting and accelerating the development of renewable energy in Benin;
7. **ARE** is the main energy regulator.

For the electricity subsector, the SBEE, the SBPE, and the CEB are the main actors with the ANADER and ABERME more focused in their areas of work.

2.1.1.2 Benin state actors for PPPs

The main state ministerial actors in the field of PPPs is the *Ministère de l'Économie et des Finances* (MEF) – Ministry of Economy and Finance. The MEF supports the mobilization of finance suitable to the financing of the PPP sector, and is the Government lead in engagement with technical and financial partners. Under the MEF, two structures play an important role in the framework of PPPs and for financing at the local level as shown below.

Name of the organisation	Mandate / Mission
Cellule d'appui aux PPP (CAPPP) - Public-Private Partnership Support Unit	The CAPPP is the technical body of the state in charge of supporting public entities in the identification of projects that can be the object of a PPP contract, in their prioritisation, in the realisation of studies on their economic viability. It also provides expertise in the execution and monitoring of the contract.
Caisse Autonome d'Amortissement (CAA) - Autonomous Amortization Fund	The body responsible for mobilizing financing resources and the sound management of the public debt. The CAA therefore presents itself as being the body through which the Ministry of Economy and Finance mobilizes financing from traditional donors on the local, regional and international financial markets for the realization of investments within the framework of the GoB investment and development program ¹⁶ .

¹⁶ CAA website - <https://www.caa.bj/missions-attributions/>

2.1.2 Technical and financial partners

The most important donors, technical and financial partners in the energy sector in Benin are:

AFRICAN STAKEHOLDERS		
Name of the organisation	Sub-entity (if relevant)	Activities in Benin (former and current related to Energy/Electricity)
African Biofuel and Renewable Energy Company (ABREC)		<p>The ABREC provides technical assistance to governments and the private sector in the areas of energy efficiency, grid-connected energy production, rural and peri-urban electrification, support for financial mobilisation, advice and training. In Benin, there is a partnership between the government and the ABREC to mobilise funds in order to promote renewable energy through a PPP. ABREC is active in 3 main projects in Benin:</p> <ul style="list-style-type: none"> - The project <i>Projet de valorisation de l'énergie solaire (PROVES)</i> for which it supported the mobilisation of resources for an amount of USD 91 million with the aims of installing 15,000 street lights using solar energy and 105 solar PV mini-power plants with storage and LV grid (for rural electrification). - The project <i>Programme Régional du Développement des Énergies Renouvelables et Efficacité Énergétique - PRODERE</i> which is providing 650 additional street lights using solar energy and 1303 low energy lamps in the cities of Cotonou and Abomey-Calavi. PRODERE is also setting 6 mini-solar PV plants and supplying 164 solar kits. - Last, ABREC is supporting the mobilisation of resources for the construction of 2 solar PV plants of 5 MW each connected to the grid of Togo and Benin for an amount of USD 25 million.
Association Interprofessionnelle de Spécialistes des Énergies Renouvelables au Bénin (AISER Bénin) - Interprofessional Association of Renewable Energy Specialists in Benin		<p>It is a grouping of national private companies whose purpose is to assist the government in the development of renewable energy in Benin, to defend the interests of actors in the renewable energy sector, to contribute to the development of renewable energy throughout the country, and to strengthen the technical capacities of its members.</p>
The African Development Bank (AfDB)		<p>The AfDB has been active in Benin since 1972. The Bank's investments in the country targeted numerous sectors including the transport sector, agriculture and food, forestry, electricity, water, or sanitation, including projects in climate resilience and adaptation to climate change. The amount of financing to this date for Benin reaches USD 709 million. For instance, Benin solicited funding from the AfDB and EBID to finance the project entitled Rural Electrification Project (PERU)</p>

		<p>- Programme d'Actions pour l'Électrification des Localités Rurales au Bénin)¹⁷ which aims at electrifying 309 rural localities to connect to the grid operated by SBEE, covering the whole country except Cotonou, and improving the efficiency of distribution networks to reduce the rate of technical losses. The project has the following three components: (a) electricity infrastructure; (b) institutional support; and (c) Project Management. The total cost is EUR 96.39 million with an estimated Bank contribution of EUR 61.77 million. Benin also joined the SE4All Initiative led by the AfDB which aims to ensure universal access to modern energy services, promote energy efficiency and renewable energies.</p>
	<p>African Union Development Agency - New Partnership for Africa's Development (AUDA-NEPAD)</p>	<p>The AUDA-NEPAD, the development agency of the African Union, is active in a wide range of sectors and activities in Benin, mostly related to agriculture, reforestation, job security, or land degradation. In the energy sector, two electricity transport and distribution infrastructure projects, the Benin-Togo-Ghana Electricity Interconnection Project and the North Core (Nigeria-Niger-Benin-Burkina Faso) 330 KV Transmission Project benefited from grants from the NEPAD Infrastructure Project Preparation Facility. Besides, the AUDA-NEPAD is one of the funders of the Gas-West African Power Pool -Domunli Regional Power Project, which includes the construction of a 450 MW combined cycle thermal power plant. The AUDA-NEPAD is also active in Benin through the SE4All initiative for which it is one of the partners of implementation.</p>
	<p>Centre Songhai</p>	<p>The Centre Songhai is a non-governmental organisation (NGO) based in Benin but also active in several neighbouring countries, which aims at the emergence of new socio-economic structures and new socio-economic developments such as "Green Rural Cities" through, among a range of other missions and activities, the promotion of renewable energy and specifically the use of solar energy and biogas in rural settings.</p>
	<p>Club Énergie Benin</p>	<p>Club Energie Benin (CENERB-ONG)¹⁸ is an NGO created in Benin in 2008 and which aims to promote the energy sector; more specifically renewable energies in Africa in general and in Benin in particular, to provide energy services to organisations and associations wishing to initiate all kinds of actions contributing to sustainable development at the grassroots.</p>
<p>ECOWAS</p>	<p>ECOWAS Bank for Investment and Development (EBID)</p>	<p>In Benin, the EBID assists the government and the private sector of Benin to finance actions in the sectors of energy, health, agriculture, new technologies, national and regional infrastructure projects, industrial transformation, especially agro-industry, trade (especially intra-African regional trade) and exports to generate more foreign exchange for the country. In the sector of energy, the EBID contributed to the project Maria Gléta (USD 17 million), a rural electrification project of 67 localities in Benin (USD 20 million), another electrification project of 100 rural localities by connection to the conventional network of the SBEE in Benin (USD 29.5 million), and an electrification project by solar photovoltaic (PV) systems of 750 community infrastructures (USD 21 million).</p>

¹⁷https://www.afdb.org/sites/default/files/documents/projects-and-operations/rdgw_-_benin_-_rural_electrification_project_peru_eng.pdf

¹⁸ <https://www.linkedin.com/company/ong-cenerb>

	<p>ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)</p>	<p>The ECREEE aspires to contribute to the sustainable economic, social and environmental development of West Africa by improving access to modern, reliable and affordable energy services, energy security and reduction of negative environmental externalities of the energy system. Its missions include promoting rural access to affordable energy in the West African region, strengthening the support for and the development of economic and technological infrastructure including the power and energy sector, and promoting provision of efficient, reliable and competitive energy sources to Member States through the common exploitation of traditional and alternative energy sources.</p>
	<p>ECOWAS Regional Electricity Regulatory Authority (ERERA)</p>	<p>The ERERA is the regional regulator of cross-border electricity exchanges in West Africa. ERERA's general mission is to ensure the regulation of cross-border electricity exchanges between ECOWAS Member States, while ensuring the implementation of conditions to ensure their rationalization and reliability and contributing to the establishment of a regulatory and economic environment favourable to the establishment of the regional market¹⁹. ERERA's headquarters are located in Accra, Ghana.</p>
	<p>West African Power Pool</p>	<p>The West African Power Pool (WAPP) aims at integrating the national power systems into a unified regional electricity market with the ultimate goal of providing a regular and reliable energy at competitive cost to the citizenry of the ECOWAS region. The WAPP is headquartered in Cotonou in Benin²⁰. The World Bank provided a grant to the WAPP Secretariat under technical assistance known as “Solar Development in Sub-Saharan Africa, Project #1 Technical Assistance to WAPP (WB-P162580)”, for the preparation of regional solar projects and technical study activities to facilitate the integration of renewable energy into the regional electricity system.</p> <p>The WAPP Secretariat and the International Solar Alliance (ISA) signed a Memorandum of Understanding (MoU) in Cotonou, Benin. The MoU establishes a collaborative partnership between the WAPP and ISA to mutually and more effectively exchange knowledge and build the capacity of WAPP member utilities in the field of solar to keep pace with the innovative and recent developments in the field of solar energy. The MOU also takes into consideration possible support and collaboration of ISA on the WAPP Regional Solar Parks Projects being executed as part of the WAPP Priority Projects²¹.</p> <p>With limited fiscal space, West African countries are increasingly shifting towards private sector participation to deploy grid-connected solar PV generation projects. The WAPP Region is endowed with high solar irradiation especially in the Sahel where Niger, Burkina Faso and Mali have the highest irradiation of the Region with an average global tilted irradiation (GTI) above 2,200 kWh per m² per year. To reduce their cost of generation and diversify their energy mix, most countries in the region are planning the development of grid-connected solar generation. With large financing needs over the sector's entire value chain, the sector is increasingly relying on the private sector that has proved strong interest in generation projects. Shifting from publicly financed projects to privately-owned ones enable to free scarce public and concessional resources for access agenda and other fiscal priorities²².</p>

¹⁹ <https://www.erera.arrec.org/fr/apercu/>

²⁰ <https://www.ecowapp.org/en/>

²¹ <https://www.esi-africa.com/solar/wapp-and-isa-sign-mou-to-build-solar-energy-capacity-in-west-africa/>

²² <https://documents1.worldbank.org/curated/en/153331525209721896/pdf/Project-Information-Documents-Integrated-Safeguards-Data-Sheet-Solar-Development-in-Sub-Saharan-Africa-Phase-1-Sahel-P162580.pdf>

<p>Independent power producer (IPPs)</p>	<p>Since the revision of the Benin-Togo Electricity Code on 23 December 2003, the electricity production segment is now open to independent producers. Some companies such as AGGREKO, APR and MRI are already active in Benin's energy market in the electricity production from fuel sources. IPPs are also active in rural electrification as they can receive approval from the ARE, contrary to the production for the national grid which is attributed to the SBEE and CEB.</p>
<p>Laboratoire de Recherche en Energies Renouvelables de l'Ecole Polytechnique d'Abomey Calavi - Renewable Energy Research Laboratory of the Polytechnic School of Abomey Calavi</p>	<p>The Renewable Energy Research Laboratory of the Polytechnic School of Abomey Calavi is responsible in Benin to ensure the certification of solar equipment. There is no certification process for other types of equipment, although there is a real capacity of expertise at national level.</p>
<p>Off-grid Clean Energy Facility (OCEF)</p>	<p>OCEF is one component of the "Access to off-grid electricity project" of the MCA-Benin II programme. It aims to increase access to electricity for the currently unserved population in rural and peri-urban areas of Benin by reducing barriers to investment in the off-grid electricity sector. The objectives of the OCEF are to improve the availability of and access to electricity for public infrastructure, businesses, communities and households, to stimulate the off-grid electrification market in Benin and to increase the adoption and use of energy efficiency devices and measures.</p> <p>OCEF uses MCC funds through partnerships with private companies, NGOs, communities, and other organizations that provide viable off-grid solutions and clean energy alternatives for Benin. It consists of a matching fund with technical assistance to promoters. The management of the OCEF has been entrusted to the international consulting firm NIRAS.</p> <p>OCEF targets four types of areas of work:</p> <ul style="list-style-type: none"> - To provide off-grid power generation and related electrical facilities to essential public infrastructures; - Decentralised production and distribution of electricity via mini-grids or micro-grids for community and/or productive use; - Home energy systems by supporting companies for the import, sale, distribution, installation and maintenance of household photovoltaic technologies, including solar home kits and similar products; - Energy efficiency measures through supporting business models for the deployment of energy efficiency measures for the benefit of public institutions, households and commercial and industrial users.
<p>West African Development Bank (WADB)</p>	<p>The WADB is active in Benin and has financed numerous infrastructure projects in diverse sectors, including energy. Its most recent financial contributions to energy related infrastructure projects include:</p> <ul style="list-style-type: none"> - the funding of an interconnection line between Togo and Benin in 2020; - the financing of the 120 MW thermal power plant in Maria Gleta in 2015; - the financing of a project to modernise and strengthen the distribution networks of the SBEE.

West African Economic and Monetary Union (WAEMU)

The WAEMU is leading the Programme for the Development of Renewable Energy and Energy Efficiency (PRODERE) in Benin which aims at installing mini-power stations/kits, solar PV street lamps and low consumption lamps. This project aims to install solar PV mini-power stations and individual kits, the installation of 533 solar street lamps in Porto Novo, Tchaourou, Toucountouna, Cotonou and Abomey-Calavi, and the introduction of 3,317 low-energy lamps in Cotonou's public lighting system. The project owner is WAEMU, the project owner delegated by UEMOA is the Société Africaine des Biocarburants et des Énergies Renouvelables (SABER) and the beneficiary is Benin through the populations of various localities

INTERNATIONAL STAKEHOLDERS

Name of the organisation	Sub-entity (if relevant)	Activities in Benin (former and current related to Energy/Electricity)
The Arab Bank for Economic Development in Africa (BADEA)		BADEA is a financial institution owned by eighteen Arab countries members of the League of Arab States. The Bank is an independent International Institution enjoying full international legal status and complete autonomy in administrative and financial matters. It is governed by the provisions of its Establishing Agreement and the principles of international law ²³ . BADEA has financially contributed since the 1970's to the construction of a large number of infrastructures (roads, bridges, schools, etc.) in Benin, as well as providing financial services ²⁴ .
CPCS²⁵		CPCS is a management consulting firm specializing in infrastructure. PPPs are relatively new in Benin, so the World Bank appointed CPCS to work with Benin government officials and stakeholders through reviewing the legal and institutional framework, build local capacity and develop a business case for two potential PPP projects ²⁶ .
European Union (EU)	EU delegation in Benin	<p>The EU is active in the energy sector in Benin, with the aim of supporting innovative solutions for access to energy, integration of renewable energies and improving the performance of energy operators. The programme "Renforcement des Capacités des Acteurs du Secteur de l'Énergie au Bénin" (RECASEB) – Strengthening the Capacities of Stakeholders of the Energy Sector in Benin, implemented by the NGO Club Energie, aims to strengthen the technical and organisational capacities of micro and small enterprises in the renewable energy sector through incubation and support activities.</p> <p>The EU contributed to the DEFISSOL project and the 25MW Illoulofin solar PV plant²⁷ which was inaugurated in July 2022. The EU is also involved in the programme "Promote sustainable energy in Benin through energy efficient and environmentally responsible solar and cooking solutions" which aims to contribute to increasing the rate of access to clean energy, particularly in rural areas, to improving access to electricity for households and productive and social uses, and to strengthening the institutional framework and encouraging reforms in the sector. The total cost of this project is EUR 5 million with a contribution of EUR 4 million from the EU and EUR 1 million from GIZ.</p>
	The European Investment Bank (EIB)	The EIB, the lending arm of the European Union, concluded an agreement in June 2022 with the solar energy company ENGIE Energy Access to give access to electricity to non-electrified areas in Benin by providing 107,000 high-quality solar home systems through 'pay-as-you-go' (PAYG) contracts ²⁸ .

²³ <https://www.badea.org/introduction.htm>

²⁴ The list of projects and initiatives supported financially by the BADEA is available here: <https://www.badea.org/Default.aspx?id=103&lg=en&countryId=41>.

²⁵ Formerly Canadian Pacific Consulting Services even though this is not used anymore.

²⁶ <https://cpcs.ca/projects/benin-building-its-public-private-partnerships-program/>

²⁷ For more information on this project see below in the section on the French Development Agency.

²⁸ <https://www.eib.org/en/press/all/2022-286-access-to-reliable-and-affordable-off-grid-energy-to-be-transformed-across-benin-under-new-eib-engie-energy-access-initiative>

French Development Agency (AFD)	<p>The AFD is active in Benin through several projects in the sectors of education, culture and adaptation. One of its current flagship projects in Benin launched in 2017 concerns the first solar PV power plant that the AFD is helping to finance entitled the DEFISSOL project. The plant was inaugurated in July 2022 and is a 25MW peak solar power plant located in Onigbolo, south-eastern Benin. The project also aims at modernizing the national electricity operator's IT system by optimizing its performance and customer service quality. This project is carried out with the support of the European Union.</p>
German Development Agency (GIZ)	<p>The GIZ is involved in Benin through the project ProMaBiP (Promotion du Marché des Biens Photovoltaïques - promotion of the photovoltaic goods market) and aims to promote the development of the quality-oriented photovoltaic goods market (certified products) by giving companies in the sector a financial contribution for the acquisition of small photovoltaic products (pico photovoltaics or solar lamps) and solar pumps. GIZ also advises municipalities on increasing their revenues and informing civil society better on how these funds are used. Besides, the African GIZ-led Green People's Energy project is active in Benin. The objective of the project is to develop decentralised renewable project, and foster local communities' actions and the private sector and investors²⁹.</p>
International Solar Alliance (ISA)	<p>ISA is a joint initiative from France and India aiming to promote solar energy. ISA aims to develop norms and standards for solar energy to achieve rapid and massive deployment in countries rich in solar radiation but where the risks are still perceived as high. ISA tools, capacity building measures and innovative financial instruments, such as harmonising public policies, regulations and tariffs between countries to reduce uncertainties, increase the economic viability of solar projects and reassure investors. In Benin, a pilot initiative is underway to define common regulatory and contractual provisions to accelerate and build confidence in solar investments.</p>
Islamic Development Bank (IDB)	<p>The IDB does not seem to be currently active in Benin, even if it is a country where it operates. Back in 2014, the IDB and Benin signed an agreement of USD 148 million of financing as contribution to the first phase of the Maria - Gleta Power Plant³⁰. The 120MW power generation facility using heavy fuel oil and gas was built to address the power shortage in the country and reduce imports of electricity from Benin's neighbouring states, thus saving up huge sums of money that the country spends for import of electricity and renting power generators.</p>
Kreditanstalt für Wiederaufbau (KfW)	<p>KfW is active in Benin focusing on projects which aim at promoting good governance, the sustainable use and protection of natural resources, improving wastewater disposal and strengthening the access to clean drinking water. It however contributed to the Construction of Onigbolo/Parakou et Sakété/Porto-Novo 161kV lines an amount of EUR 14.25 million.</p>
SNV	<p>SNV is a Dutch not-for-profit international development organisation that works in poverty alleviation. They focus on three sectors (agriculture, energy as well as water, sanitation and hygiene) and have a long-term, local presence in around 24 countries in Asia, Africa and</p>

²⁹ Source: <https://www.giz.de/en/worldwide/77417.html>

³⁰ See below section 3.4.4

		Latin America ³¹ . They are aiming to implement SDG7 in Benin through integrated energy planning ³² and distributing solar lights in partnership with MTN ³³ .
The Millennium Challenge Corporation (MCC)		<p>The MCC is partnering with Benin to tackle the limited access to and availability of electricity in the country and the inadequate maintenance and insufficient investment in the sector, through a USD 391 million compact that is reforming and modernizing its energy sector. The compact aims to strengthen the national power utility, attract private sector investment into solar power generation, and fund infrastructure investments in electricity distribution as well as off-grid electrification for poor and unserved households. The compact includes four projects:</p> <ul style="list-style-type: none"> - An electricity distribution project which aims at expanding grid capacity, accommodating future demand growth, improving service reliability, reducing losses, and minimizing outages through improving the power grid. - An electricity generation project through a solar PV generation through an IPP transaction. - An Off-Grid Electricity Access Project whose objective is to address the gap in access to electricity through policy reforms, infrastructure financing, and PPPs, through mini-grid projects. - A policy reform and institutional strengthening project which has led to reforms in the Benin's power sector, an electricity tariff increase, a four-year management contract for the national power utility, and government approval for an IPP framework that has resulted in internationally competitive bidding for solar power plants. The project has also supported energy efficiency audits for public buildings and private industry in order to reduce demand and costs.
United Nations (UN) agencies and specialised institutions	UN Capital Development Fund (UNCDF)	The UNCDF has been present in Benin intervening over the past three decades with projects aiming at reinforcing the decentralization process, strengthening national capacities to support local economic development, and improving food security. Currently, the UNCDF is active with the project Local Climate Adaptive Living Facility which aims at providing a mechanism to increase awareness and response to climate change at the local level, integrate climate change adaptation into local governments' planning and budgeting systems, and increase the amount of finance available to local governments for climate change adaptation. UNCDF was also active in Benin recently (2015-2019) to support digital finance in a variety of areas: digital infrastructure, policy and regulations, as well as supply side and demand side challenges.
	United Nations Development Programme (UNDP)	The UNDP contributes to the project MCC in Benin through the National budget counterpart funds with an amount of EUR 0.76 million.

³¹ <https://snv.org/sector/energy>

³² <https://snv.org/update/reaching-sdg7-benin-integrated-energy-planning>

³³ <https://snv.org/update/more-bright-lights-benin>

<p>The World Bank</p>	<p>The World Bank is active in three main types of activities in Benin: structural transformation of the economy to promote competitiveness and productivity; investing in human capital; and enhancing resilience and reducing climate-related vulnerabilities. In the energy sector, the World Bank is leading a project aiming at installing two resilient photovoltaic (PV) systems consisting of two metal kiosks, two sheds and two resilient mini PV power plants providing energy services (electrification, recharging of lamps and GSM mobile phones based on solar energy, freezing services for fresh products and medicines in rural areas, etc.) and thirty solar candelabras as adaptation measures for the electrification of vulnerable communities off the conventional grid in the localities of Bobè (Bantè) and Bantè (Bantè).</p>
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2.2 Assessment of renewable energy mix and energy access status-quo in Benin

2.2.1 Current state of the energy landscape in Benin

Like the majority of its neighbouring countries, the energy sector in Benin is characterised by its heavy reliance on biomass and low access to electricity, especially in rural areas. The demand for electricity in Benin has been growing steadily, due to sustained economic growth (over 5% in 2015), population growth and rapid urbanization. Currently, the country relies on electricity imports from other West African countries for its power and other energy products. Around 85% of its electricity consumption is met by electricity imports from Ghana, Cote d'Ivoire, and Nigeria³⁴, stressing the need for more local options to reduce risk and vulnerability to external shocks, and ensure energy access that will support economic progress.

However, the country has an immense potential for renewable energy and is currently engaged in a rapid energy transition through (a) the setting of ambitious renewable energy and energy efficiency goals (b) the rapid development of solar energy production, and (c) the update of its energy policies, plans and regulations with regards to renewable energies.

2.2.1.1 Energy consumption

Benin's total energy consumption is about half of the average per capita energy consumption for Sub-Saharan African countries, and less than a quarter of the world average (World Bank, 2009). Although the final total energy consumption has noticeably increased, the structure of final energy consumption has not changed. The lack of access

³⁴ https://energypedia.info/wiki/Benin_Energy_Situation

to energy in Benin is negatively affecting the economy of the country at around 2% of GDP each year.

As seen in Figure 3, households (48%) were the primary consumers of energy in Benin in 2020, followed by the transport (37.5%) and service sectors (10%)³⁵. In terms of electricity consumption, households accounted for almost 38% of the country's total electricity consumption in 2020. This is followed by the service sector and the industrial sector, which account for 33.5% and 25% respectively.

2.2.1.2 Energy sources

Like most countries in Sub-Saharan Africa, Benin's energy sector is largely dominated by the use of biomass-based energy sources (55.1%), followed by petroleum products (40.3%) and, to a lesser degree, electricity (2.8%)³⁶.

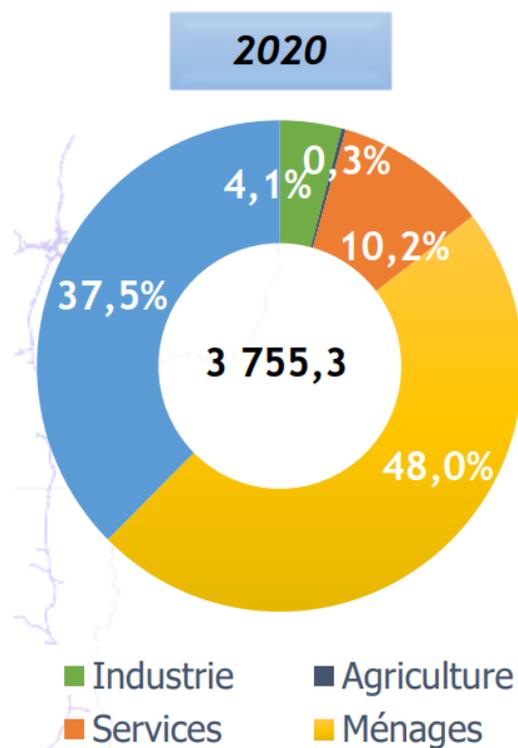


Figure 3: Benin energy consumption by sector

The country's energy supply is largely externally-sourced, which exposes it to external shocks over which it has no control. Benin imports almost all of the petroleum products it consumes, making it vulnerable to exchange rate fluctuations and oil prices. Fluctuations in fossil fuel prices further compromise Benin's domestic capacity to develop its energy services. Accessing alternative local energy sources, such as solar PV, can reduce the risk and provide better energy security over the long term.

Currently, charcoal is produced from wood mainly using traditional millstones. This process has a very low efficiency rate. The weight yield for the production of charcoal is estimated at 15% considering the types of carbonization wheels used. This yield makes it possible to estimate the quantity of firewood used for carbonization. Charcoal production increased from 259.7 ktoe in 2010 to 330.5 ktoe in 2015, an increase of 4.9% between 2010 and 2015.

³⁵ Chiffres clés 2021 – Bilans énergétiques et indicateurs 2016 à 2020

³⁶ <https://direction-energie.gouv.bj/telecharger-chiffres-cles>

The country has a huge and untapped renewable energy potential³⁷. The documented solar energy potential ranges between 3.9 in the south of the country and 6.2 kWh/m² in the north (see Figure 4). For an installed capacity of one kWp, the annual production is estimated at 1560 kWh in the north, 1460 kWh in the centre and 1400 kWh in the south (in wetlands). The largest electricity production sites (thermal or photovoltaic) would therefore be ideally located in the north and central-west regions³⁸.

Figure 5 shows the population density, with the rural central and northern parts of the country being suitable for solar PV, and especially mini power plants and kits.

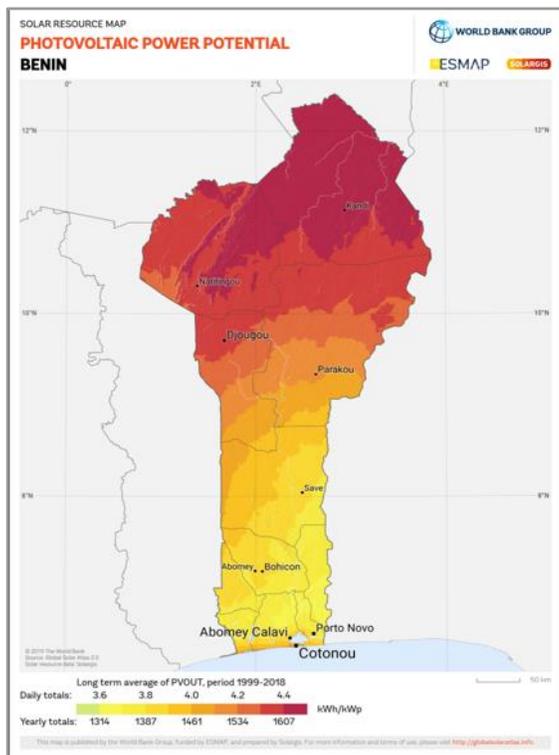


Figure 4: Map of solar photovoltaic potential in Benin

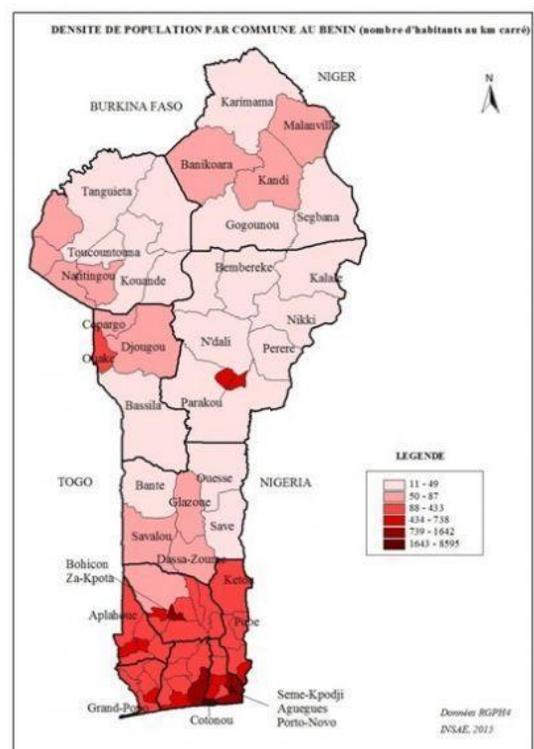


Figure 5: Population density of municipalities in Benin

While Benin has a large hydroelectric potential, only one major hydropower station currently functions. Development of over 80 pre-identified sites using micro-hydro applications would help Benin increase its energy resilience. There is a commercially viable potential of 760 MW on the River Oueme, as well as potential to support rural electrification through exploiting the over 80 other sites with small-scale hydropower plants³⁹.

³⁷ Plan Stratégique du Ministère de l'Énergie 2020-2024, p.20

³⁸ Politique nationale de développement des énergies renouvelables - PONADER, p.6

³⁹ [https://wedocs.unep.org/bitstream/handle/20.500.11822/20483/Energy_profile_Benin.pdf?sequence=1&isAllowed=y#:~:text=About%20448%20kW%20of%20solar,m%2C%20\(REEEP%2C%202012\).](https://wedocs.unep.org/bitstream/handle/20.500.11822/20483/Energy_profile_Benin.pdf?sequence=1&isAllowed=y#:~:text=About%20448%20kW%20of%20solar,m%2C%20(REEEP%2C%202012).)

Other renewable energy sources which are currently being considered by the GoB include bioenergy, with a great potential for biogas production from waste.

2.2.1.3. Access to electricity

There is a disparity of electricity access between urban and rural citizens. In 2020, around 36.5% of the population had access to electricity, leaving approximately 1.5 million citizens without access, with 1.1 TWh of total annual consumption, and an average peak daily load of 180 MW. The urban population had significantly greater access at 64.9%, while **only 10.4% of the rural population had access**⁴⁰. While the urban population has proportionally more access to electricity, they also face issues such as electricity shortage and outages.

2.2.1.4 Electricity production constraints and reliance on imported electricity

National production of electricity—from both public power stations connected to the network, and self-producers with their own means of production—increased significantly between 2010 and 2015. It amounted to 323 GWh (27.8 ktoe) in 2015, whereas in 2010 it was only 113.6 GWh (9.8 ktoe). This production, in 2015, was obtained from thermal power plants using oil products (37.7 ktoe in 2015 against 35.3 ktoe in 2010) and natural gas (31.1 ktoe in 2015).

This increase in electricity production is due to the increase in the production of public power stations and self-producers in order to make up the shortfall in electricity provided by the Electricity Community of Benin (CEB)⁴¹. As in the broader energy sector, Benin is heavily **reliant on imports** for its electricity consumption, with over 80% of its electricity requirements coming from other states of the West African region (mostly Nigeria and Ghana, but also Côte-d'Ivoire).

Due to its reliance on imports and its inadequate electricity infrastructure, Benin has suffered from a widespread shortage of electricity from 2015. An analysis of the situation of the electrical energy sub-sector reveals a low level of development of modern energy

⁴⁰ <https://direction-energie.gouv.bj/telecharger-chiffres-cles>

⁴¹ <https://are.bj/laproduction/>

production capacities. The lack of operational capacity at the distribution utility, SBEE, did accelerate these issues.

To address the electricity crisis, the GoB procured an additional power plant (Maria Gléta 2), and supported the rehabilitation of existing power plants⁴². The situation changed in 2016 and 2017 when the GoB installed electricity generation capacity in the form of rented, diesel-powered generators, at a substantial cost to the GoB⁴³. In 2020, the share of renewable energy sources in electricity production was only 7.5%⁴⁴. With the opening of the first solar power plant in July 2022, this share will likely increase.

The electricity sub-sector remains vulnerable due to a lack of diversity of sources, and a dependence on costs linked to international market prices. By encouraging a stronger focus on PPP solutions, Benin will support additional public power stations that can connect to the network and provide better energy security for the country.

2.2.2 Main challenges in Benin energy sector

Beside the challenges already mentioned above (the rapidly increasing demand for electricity, the low access to electricity in rural areas, reliance on imported energy and electricity sources), Benin is confronted to the following challenges in the energy sector and the electricity sub-sector:

2.2.2.1 Non-sustainable use of biomass

Around 80% of the population depends on the use of biomass for its cooking needs. Since 2004, there has been an overall shortfall in the supply of wood for energy and cooking at the national level, with wide variation at the regional level. The unsustainable cutting of wood has resulted in massive degradation of forest resources and of ecosystems. While consumption increased between 2005 and 2015 at an annual rate of 5%, forest areas were reduced by over 20% (i.e. 1.6 million hectares), the annual decrease rate being as high as 2.2%⁴⁵. This significant growth increases the pressure on wood resources and should

⁴² Available at: <https://documents1.worldbank.org/curated/en/238461468211474797/pdf/PID0Appraisal005182008.pdf>

⁴³ <https://www.mathematica.org/publications/evaluation-of-the-benin-power-compacts-electricity-generation-and-distribution-projects-baseline>

⁴⁴ Chiffres clés, p.17

⁴⁵ Source: bit.ly/3MAgRXf

encourage the implementation of strategies for the sustainable management of forest resources including substitution.

2.2.2.2. Financial constraints and lack of infrastructures

While Benin has many energy resources such as solar, hydro, and wind energy, it lacks the infrastructure both to convert these resources into electricity, and to transport the electricity throughout the country⁴⁶. The majority of Benin's power plants and other energy facilities were built in the 1950s and 1960s, and the lack of recent investment has led to deterioration of the power capacity over time⁴⁷. Due to limited financial and budgetary capacities at the state level, the energy sector is characterised by under-investment in generation, transport, and distribution infrastructures, which is a major structural constraint hampering the delivery and performance of services. These resources (external and internal, financial and human) mobilised for the energy sector fall far short of its needs in relation to the challenges it currently faces. They are sometimes inadequate, with mobilisation difficulties having a negative impact on their effectiveness.

CEB and SBEE, the operators who carried out production and distribution activities⁴⁸, are in a difficult financial situation, reflected in deficits and structural debts, their survival depending on fairly substantial investment subsidies. Their structural balance, therefore, remains fragile and requires rigorous management to restore and guarantee their profitability. The financing constraints of the sector cause strategic bottlenecks to development, due not only to the scarcity of appropriate resources but also to the low adaptability of the means available.

The distribution network is characterized by technical and commercial loss rates that ranged from 20% to 24% (combined) in 2019, as well as frequent overloads and excessive voltage fluctuations⁴⁹.

The sector's difficulties over the past few years have been exacerbated particularly by frequent selective power cuts on the national grid. These power cuts are due to:

⁴⁶ <https://www.imf.org/en/Publications/CR/Issues/2016/12/31/Benin-Poverty-Reduction-Strategy-Paper-Growth-Strategy-for-Poverty-Reduction-21867>

⁴⁷ https://en.wikipedia.org/wiki/Energy_in_Benin

⁴⁸ See below the section 2.4.1 for more information on both these actors.

⁴⁹ <https://www.mathematica.org/publications/evaluation-of-the-benin-power-compacts-electricity-generation-and-distribution-projects-baseline>

- a) the reduction in the quantity of power imported from the main supplier countries which can no longer supply the CEB (Benin and Togo) with the contractual quantities of energy, since they now have to prioritize the steadily growing demand in their own country, as well as CEB's unpaid bills owed to these external suppliers;
- b) shortage of fuel supplies to IPPs, which in 2015 accounted for nearly 90% of the electricity generated locally in Benin. This national production helped to satisfy nearly 8% of local electricity demand in 2015, with the remaining 92% provided by the CEB (imported and locally produced community hydroelectric and thermal power); and
- c) the lack of significant investments to rehabilitate SBEE's production and distribution plants.

Demand far exceeds supply, causing frequent power cuts that hamper economic activities, particularly those of the informal sector and very small-, small- and medium-sized enterprises which do not have the means to buy back-up generators, nor obtain a regular supply of fuel.

The absence of hazard or siting maps for equipment installation means that Benin's existing energy infrastructure remains extremely vulnerable to anticipated climate change impacts. While Benin's National Adaptation Action Plan notes the necessity of an emergency response plan to deal with the impacts of meteorological extreme events, this plan has yet to be developed.

2.2.2.3 Governance challenges

The energy sector needs significant reform in terms of planning and capacity among institutional actors, and much work is needed on strategy, coordination, planning, pricing and monitoring. Moreover, the structural change in the size of the energy sector, particularly in terms of production, could place additional pressure on current operational functions (implementation, technical feasibility, environmental assessment, operation, and system maintenance and management). As a result, the GoB is increasingly relying on private sector intervention in the sector of energy⁵⁰. Not having an independent regulator for the sector also makes enforcing correct practices on private players difficult.

⁵⁰ Plan Stratégique du Ministère de l'Énergie 2020-2024. p29-30.

2.2.2.4 Incoherencies and weaknesses of the regulatory framework⁵¹

The energy sector suffers from a number of structural weaknesses, incoherencies and gaps, even though the code of electricity was recently updated in 2020. This hampers the capacity of the country to be self-sufficient in both these sectors. The regulatory framework is not sufficiently robust to promote efficiently renewable energies in Benin. The lack of transparency in the decision-making and attributions are not conducive for the private sector investments leading to a lack of appropriate financial incentives for risk reduction for private energy developers. Therefore, the regulatory framework is not attractive for investments. No specific policy to specifically promote renewable energy has been set up, except for the annual finance law which deals with the exemption of taxes (customs duties and VAT) on solar equipment since 1 January 2013.

2.2.2.5 Lack of adequate human resources

Due to low levels of domestic capital formation and little internal capacity (engineers, technicians, etc.) and expertise, Benin faces difficulties in planning, developing, financing, and managing renewable energy power plants in the public sector. Moreover, for the same reasons, the country struggles to support the development of a commercially viable renewable energy industry despite the existing potential.

2.3 Key energy policies and frameworks

2.3.1 Regulatory framework

The Government of Benin has demonstrated commitment to power sector reform by opting for a management contract to run its national electricity distribution utility, the Beninese Electricity Company (SBEE), as well as enacting a new energy code that supports IPP investments. The GoB has adopted tariff reforms, but rate increases are pending⁵².

The legal framework is provided by the Structural Reform of the Electricity Sector (No.98-032 1998), the law 2020-05 of 1 April 2020 on the Code of electricity in Benin. It is an update of the law 2006-16 on the Code of Electricity which provided the previous regulatory framework. Another important law is the law 2009-02 on the procurement and public service delegation contracts. Other decrees concern the minimum performance and

⁵¹ Plan Stratégique du Ministère de l'Énergie 2020-2024

⁵² Available at: <https://www.usaid.gov/powerafrica/benin>

labelling standards, or related to the creation and functioning of state actors for the sub-sector of energy. These are further explained in 3.4

2.3.1.1 Decree on the Rural Electrification Fund

The decree n° 2008-719⁵³ of the 22 December 2008 establishes the modalities for the operation and management of the Rural Electrification Fund (*Fonds d'électrification rurale – FER*). The FER is intended exclusively for the development of electrification in rural areas and is the sole mechanism for financing rural electrification, and is managed by the ABERME. The GoB is planning to create an Energy Development Fund (*Fonds de développement de l'Energie*) which should gather the FER and two newly funds which are the Renewable Energy Fund (*Fonds des énergies renouvelables*) and the Energy Efficiency Fund (*Fonds de l'efficacité énergétique*).

The FER aims at financing investments in generation, transmission, distribution and connection of tariff customers targeting rural areas, through subsidies for the project subject to authorisation and provide loans to operators. It also promotes the development of rural electrification through pilot projects, information campaigns, communication, training and organisation of stakeholders. It also finances studies for setting up rural electrification projects and guarantee loans requested by operators through banks.

2.3.1.2 Decree on off-grid electrification in Benin

The decree n° 2018 - 415⁵⁴ of 12 September 2018 on the regulation of the off-grid electrification in Benin provides a legal basis for the Off-Grid Electrification Policy and its Master Plan. The decree defines the types of off grid electrification projects subject to the authorisation regime and those that require a concession agreement. It introduces a light regulation concerning the granting of incentives to the merchant sector.

The main regulatory instruments for off-grid electrification in Benin are:

- Authorisation - applicable to the EHR 1 category⁵⁵: for any cumulative installed capacity of strictly less than 500 kW under an unsolicited proposal; and
- Concession - applicable to EHR 2 category: for any cumulative installed capacity equal to or greater than 500 kW, on the basis of a call for projects.

⁵³ Available at: <http://are.bj/wp-content/uploads/2017/09/De%CC%81cret-n%C2%B0-2008-719-du-22-de%CC%81cembre-2008-portant-constitution-et-modalite%CC%81s-de-fonctionnement-et-de-gestion-Fonds-dElectrification-Rurale-FER.pdf>

⁵⁴ Available at: <https://are.bj/wp-content/uploads/2018/11/DECRET-HORS-RESEAU.pdf>

⁵⁵ EHR stands for *Electrification hors réseau*, translated as Off-Grid Electrification

To date, the potential offered by the evolution of this legal framework has not been truly exploited, especially with regard to the opening up of electricity production to private actors: neither local companies nor technical and financial partners have been able to benefit from this relaxation of the legal framework. This difficulty of application particularly concerns the renewable energy sector for which no specific law has been enacted, apart from the two finance laws (2008 and 2015). It is true that the ANADER, created in 2014, has the task, among other things, of setting the rules governing this sector in Benin, but for the time being nothing has yet been done to define the status of the private producer, while many households produce their own electricity.

In short, the Beninese state's action towards PPPs remains relatively modest for the moment, and not very decentralised. The local infrastructure installed is still underdeveloped, on top of the crucial issue of network operation and management. The decentralised structures of the State, the Departmental Energy Directorate in charge of implementing the national energy production policy, the local branches of SBEE, and the ABERME, have not taken any concrete action regarding decentralised energy production, via solar technology for instance.

Even in the field of training, which is central to the development of renewable energies, the intervention of public actors is limited to the University of Cotonou. On the other hand, it was a private initiative that led to the creation in 2009 of the Liweitari Training Centre, which offers vocational training in order to fill the gap in technical expertise in the field of electricity and renewable energies.

2.3.2 Key policies and plans related to the energy sector

The main policies and plans related to the energy sector in Benin are the Plan d'Action National des Energies Renouvelables⁵⁶ (PANER - Renewable Energies National Action Plan), the *Plan d'Action National d'Efficacité Energétique*⁵⁷ (PANEE - Energy Efficiency National Action Plan), and the *Plan Stratégique du Ministère de l'Énergie 2020-2024* (Strategic Plan of the Ministry of Energy), the *Programme d'actions pour la période 2016-2021 pour le développement énergétique*, and the *Programme Énergétique d'Urgence National* (PEUN) 2015 – 2030. These plans and programs set the national objectives and targets related to

⁵⁶https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANER/Benin_Plan_d_Actions_National_pour_les_Energies_Renouvelables_PANER.pdf

⁵⁷https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANEE/Benin_Plan_d_Actions_National_pour_l'E2%80%99Efficacite%CC%81_Energie%CC%81tique_PANEE_.pdf

renewable energies development and production, including solar energy. For electricity, the *Plan directeur de développement du sous-secteur de l'énergie électrique au Bénin* (DAEM) is the main plan specifically focusing on the sub-sector.

In addition to the above, the GoB adopted a *Politique Nationale de Développement des Énergies Renouvelables* (PONADER) - National Policy for the Development of Renewable Energies, covering the period from 2020 to 2030, with a view to facilitating faster access for populations to modern energy services, including renewable energies and specifically solar energy⁵⁸. The PONADER serves as a reference framework for the development and implementation of renewable energy projects and programmes in Benin. Its main objectives are to (1) strengthen production capacities from renewable energy sources and (2) develop and promote modern energy in the rural areas.

The PONADER is divided into three strategic objectives, namely (a) to develop the country's real potential in renewable energy, (b) to promote technologies for the development of renewable energy resources and (c) to promote the emergence of an institutional and regulatory governance environment conducive to the development of renewable energy. It also advocates for the creation and implementation of a loan guarantee fund for the development of renewable energies to ensure the financing of renewable energy projects and to promote sustainable agriculture, sustainable forest management and the introduction of a tax incentive which could help mobilise resources for investment in renewable energy.

Since March 2014, the rural electrification policy document in Benin presents the regulatory framework to facilitate the establishment of an enabling environment for off-grid electrification in Benin. It defines in a global way the rural electrification policy of Benin. ABERME in collaboration with DGRE and ANADER are responsible for its implementation. Extension to the electricity grid and decentralised electricity from mini-grids and solar kits are practiced. More than 100 localities are electrified per year.

The main objective is to promote off-grid electrification and to mobilise renewable energies both to diversify the electricity mix, but also to be the primary source of off-grid. The main objective is to ensure universal access to electricity service for the rural population of Benin by 2035.

⁵⁸ <https://energie.gouv.bj/article/politique-nationale-de-developpement-des-energies-renouvelables>

According to the PANER⁵⁹, Benin aims to provide access to electricity to 100% of its population by 2030. The main national goals expressed in the PANER related to renewable, especially solar energy are to reach an installed capacity of renewable energy plants of 810.2 MW by 2030, corresponding to a share of renewables of 18.8% of the total installed capacity by 2030. Benin aims at reaching a total electricity generation from renewable energy sources on the grid of 2412.2 GWh. Besides, the share of renewable energy in the electricity mix must reach 35.1%, and the share of the rural population served by off-grid systems (mini-grids and stand-alone systems) of renewable energy-based electricity services is 5%. For solar energy, the national objectives are to reach a grid capacity of 227.9 MW by 2030, through small scale (ground or roof) solar PV (1.6 MW) and medium and large-scale solar PV plants (226.3 MW) corresponding to a generation capacity of 2.39 GWh and 566.8 GWh respectively. Benin has also set up goals regarding the production and number of solar water heaters used in the country by households, private and public entities (for instance, 80% of health centres and schools should be equipped with solar water heater by 2030).

In September 2015, Benin articulated its energy-related Intended Nationally Determined Contributions (INDCs), aiming to contribute to reducing cumulative GHG emissions from current emissions. The following key mitigation measures were proposed in the IDNCs:

- Promote solar PV powered public lighting in rural and peri-urban areas by providing households with up to 1 million solar lamps and bulbs;
- Promote solar power plants construction by building 40 MW total capacity of solar power plants;
- Increase hydroelectricity production;
- Promote household access to liquefied natural gas (LNG) and its related equipment for cooking;
- Increase electricity production from natural gas by building a 400MW natural gas plant;
- Build an LNG storage and regasification unit as well as a connecting pipeline to the gas terminal in the port of Cotonou;
- Promote affordable cooking stoves: disseminate 140,000 improved cooking stoves;
- Promote high efficiency carbonization stoves;
- Create plantations for fuel wood industry for a total area of 5,000 ha;
- Others relating to transport.

⁵⁹https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_PANER/Benin_Plan_d_Actions_National_pour_les_Energies_Renouvelables_PA_NER_.pdf

3 Overview of PPPs in Africa and Benin

Public-private partnerships, in relation to climate finance, are an “interaction between the public and private sector for the delivery of climate projects or initiatives”⁶⁰. They aim to utilise the strengths of the private sector to provide public goods, whilst still maintaining some degree of oversight and governance in a project. How much control they have is dependent on the project structure arrangement. They can be a useful tool in attractive skills and investment into strategic priority areas for governments, whilst shifting some of the workload in performing functions for the benefit of society.

3.1 Landscape of solar PV in Africa

According to the "World Sunshine Map"⁶¹, Africa receives many more hours of bright sunshine during the course of the year than any other continent on Earth. The International Renewable Energy Agency (IRENA) estimates Africa's solar technical potential at 7,900 GW (assuming a 1% land-utilisation factor). Solar energy is currently the fastest-growing renewable energy source in Africa with an average compound annual growth rate of 54%. Solar photovoltaics (PV) remains the technology that attracts most of the investments globally compared to other renewable alternatives. Solar PV attracted USD 18 billion between 2010 and 2020 representing 33% of cumulative investments in Africa over that period, followed by onshore wind (31%, or USD 17 billion) and solar thermal (16%, or USD 9 billion).

Despite this noticeable momentum of large solar potential, penetration of solar power in Africa's energy sector is still very low and it has been exploited only in a few countries. The main impediment hindering the uptake of solar power is the compelling lack of investments in the continent; only 2% of global investments in renewable energy went to Africa. Adding to that, this meagre share of investments is unevenly distributed between countries. While three countries namely South Africa, Egypt and Morocco⁶² account for more than 80% of Africa's installed solar generation capacity, West Africa only accounts for 7% of the continent's investments in renewables. Therefore, African countries endeavour to mobilise investments and couple various sources of finance. The most significant challenge for public authorities is to attract private capital. Contrary to the global trend where public finance accounts for just 14% of direct investments in renewable energy assets⁶³, public

⁶⁰ <https://norden.diva-portal.org/smash/get/diva2:915864/FULLTEXT01.pdf>

⁶¹ Powell, R.; Bowden, D.; Tresemer, D.; Bento, W.; Farrants, W.; Gray, B.; Dann, K.; Paul, L.; Lainson, C.M.L.; Nurney, S. (2012). *Journal for Star Wisdom 2013*. Lindisfarne Books.

⁶² <https://www.irena.org/publications/2021/March/Renewable-Capacity-Statistics-2021>.

⁶³ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_RE_Jobs_2021.pdf

finance plays a leading role, along with international donors and financing institutions in Africa. Most countries on the continent struggle to appeal to private capital. This is due to the institutional, financial and legal risk and the nature of the local market that is nascent with only 40% energy access, and not completely structured where the informal sector plays a big role and present many barriers to entry. However, alternative sources of finance are emerging in the continent as a viable source for renewable investments in African countries such as IPPs schemes through private sources and from development finance institutions (DFIs) and multilateral development banks (MDBs). Support for IPPs from DFIs and MDBs takes many forms, including direct investment (equity and debt), technical assistance, risk mitigation, and structured procurement programmes combining all those instruments⁶⁴.

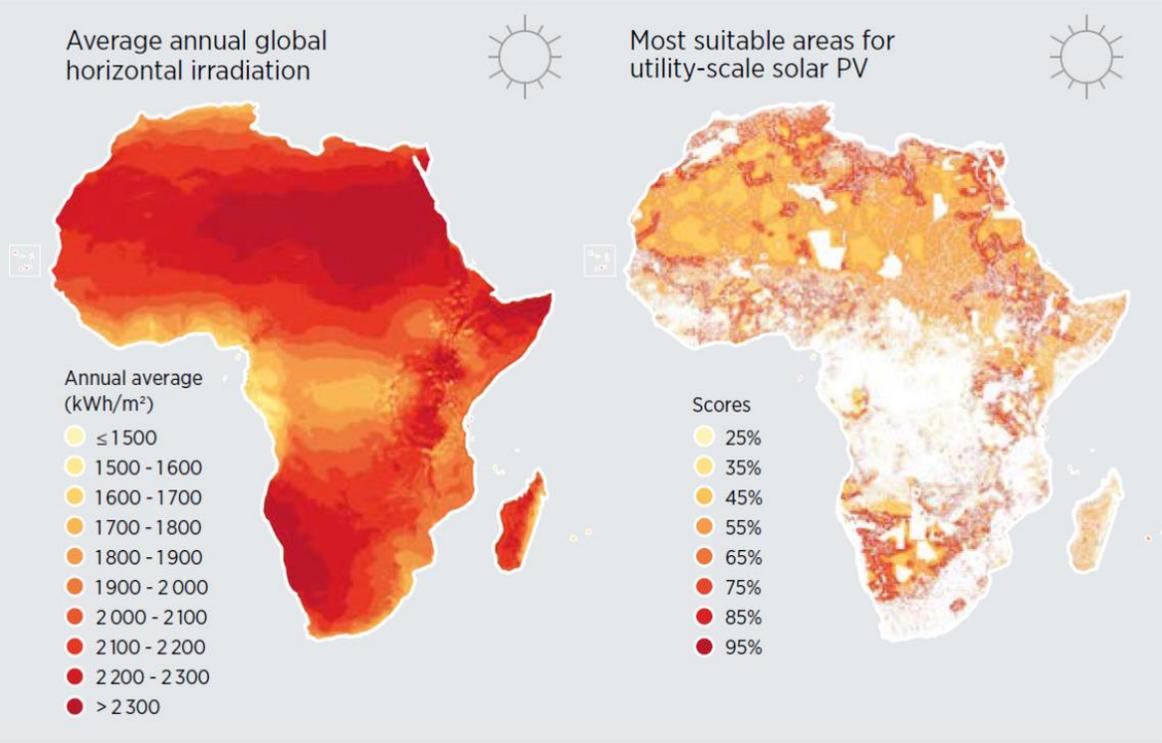


Figure 6: Average annual global horizontal irradiation and the most suitable areas for utility-scale solar PV in Africa⁶⁵

3.2 Public-private partnerships in Africa

The World Bank makes an important distinction of PPPs in Franco- versus Anglophone countries. Namely, user-paid PPPs (instead of a concession-PPP or *PPP concessif* in French), or PPPs in which the public makes payments to the private party in exchange for making a

⁶⁴ IRENA Market Africa 2022

⁶⁵ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jan/IRENA_Market_Africa_2022.pdf

public asset or service available, referred to as availability-based PPPs (*paiements publics in French*). Power generated through IPPs fall in the latter description⁶⁶.

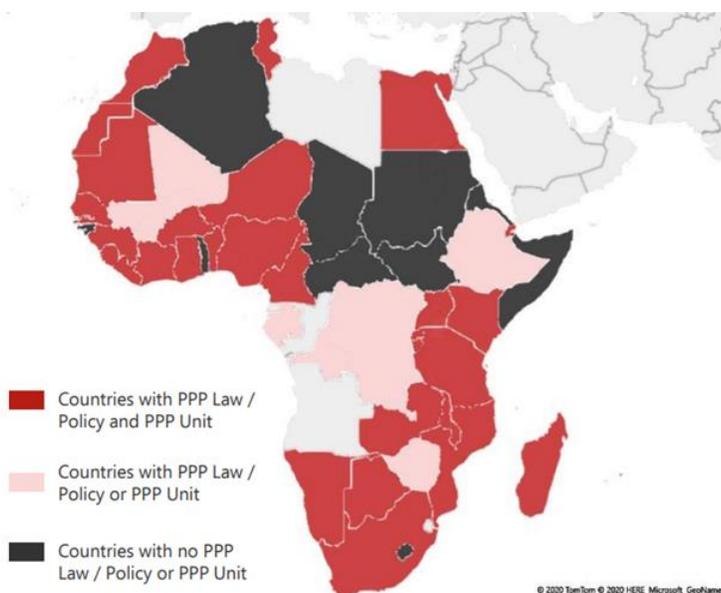
Such PPPs⁶⁷ are now emerging as a viable source of infrastructure investment in developing countries. PPPs are seen as a solution to leverage private sources of finance for delivery of public assets and services, while providing opportunities to optimize the quality of such services⁶⁸. A successful PPP arrangement capitalises on the strengths of both the private and the public sector to provide a better and more cost-effective service, and speed up the rate of its implementation or coverage.

Three key drivers have been identified to implement PPPs⁶⁹:

- enhanced “value-for-money”, through the allocation of different risks to parties most suited to manage them, resulting in reduced costs over project life-cycles;
- improved implementation and service delivery, benefiting from the specific and complementary characteristics of public and private actors; and
- increased financial leverage, supported by a range of policy and financial instruments that can be deployed in climate finance PPPs.

The growing interest of PPPs is evidenced by the fact that the majority of African countries have already laid the enabling frameworks for PPPs in the form of PPP legislations or regulations and PPP units. Based on the African Legal Support Facility PPP Country Profiles, 33 out of 54 African countries have already put in place a PPP law or policy and a PPP unit, with a further fourteen countries putting in place both (see Figure 7).⁷⁰

Figure 7: Map of the evolution of the PPP regulatory context



While most of the countries have a PPP policy, only a handful of countries—South Africa, Morocco, Nigeria, Egypt, and Ghana—

⁶⁶ <https://cpcs.ca/three-criteria-to-better-classify-ppps-in-africa/>

⁶⁷ https://uongozi.or.tz/wp-content/uploads/2017/03/Public-Private-Partnerships-in-Sub-Saharan-Africa_Digital_FINAL-4.pdf

⁶⁸ https://www.afdb.org/sites/default/files/2020/09/15/afdb_ppp_framework_whitepaper.pdf

⁶⁹ <https://norden.diva-portal.org/smash/get/diva2:915864/FULLTEXT01.pdf>

⁷⁰ https://www.afdb.org/sites/default/files/2020/09/15/ppp_framework_session_1.pdf

concentrate more than 50% of all PPPs in Africa by value⁷¹ with a predominance for the energy sector. Nevertheless, many African countries, such as Senegal, Burkina Faso, Botswana, Namibia and Rwanda, have set high PPP ambitions, having numerous PPPs in pipeline or planning stages. The challenge remains to overcome hurdles impeding PPPs in Africa⁷².

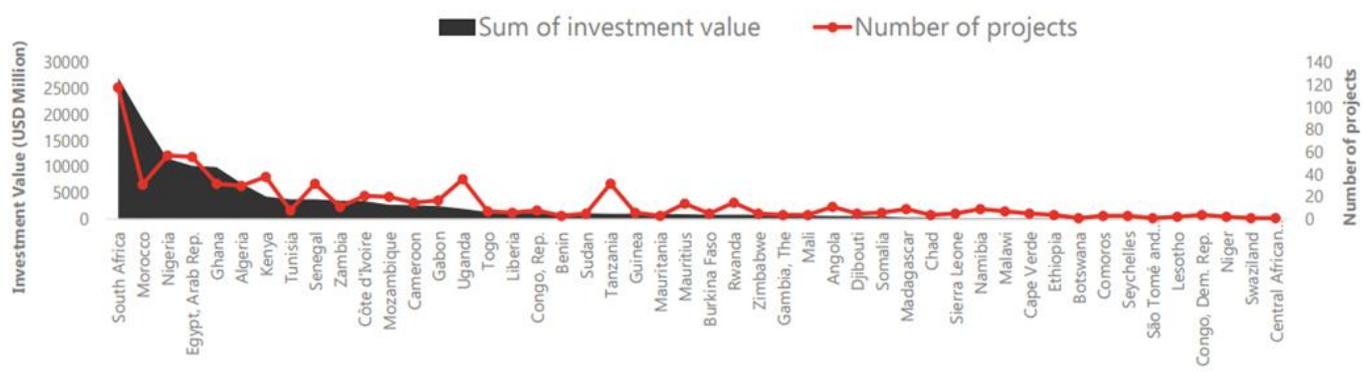


Figure 8: : Sum of investment value and number of PPP projects by African countries⁷³

3.2.1 Challenges facing PPP uptake in Africa

The readiness of African countries to access the full potential of PPPs is still questioned. The complexity of processes and inherent challenges to PPPs are common challenges. However, the African context poses a particular set of challenges deriving from structural barriers and unique contingencies.

- Limited internal capacity:** The main challenge is associated with the inadequate capacity of the countries in identifying, developing, structuring, and bringing bankable PPPs to the market. African countries have typically been dealing with structuring and managing public funded infrastructure facilities and services. But procurement of PPPs is very different from that of traditional government contracts. PPP transactions require a specific set of skills to be available to the government sponsor, in the areas of finance, contracts, engineering and design, environmental and social impacts, and procurement.

⁷¹ PPI Database, World Bank Group (2019)

⁷² https://www.afdb.org/sites/default/files/2020/09/15/ppp_framework_session_2.pdf

⁷³ https://www.afdb.org/sites/default/files/2020/09/15/ppp_framework_session_2.pdf

- **Indefinite or ambiguous regulatory framework:** From a legal perspective, African countries still struggle to develop a comprehensive framework and regulation capable of PPPs. Furthermore, there is a lack of high-level policy direction. Governments do not provide clear, understandable and transparent intent that will allow the private sector to commit to a PPP project.
- **Fragile trust:** In most African countries the main reason hindering PPPs development is the limited trust between public and private sector professionals⁷⁴ due to the high risk-perception of investors. Frequent political leadership change menaces the policy environment of PPPs, further accentuating the precarious existing trust. Moreover, economic instability is a major concern for private partners. External contingent liabilities triggered by force majeure risks⁷⁵ represent a great source of exposure.
- **Financial constraints of governments:** A prevailing challenge to African countries is financial. In nascent PPP markets, private investors are not always able (or willing) to completely finance the capital investment for public infrastructure. Therefore, private finance will not completely replace public finance. Governments may have to participate in the financing of projects implemented through PPPs.
- **Lack of financing choices in the domestic financial markets:** In a nascent market, the availability of local sources of finance is scarce, domestic actors are not able to mobilize resources to participate in PPPs, adding to that the complexity of processes and the scale of PPP projects reduce the chances for local sources to play a role. Furthermore, low levels of income do not allow other types of finances in funding PPPs through user charges and other sources of revenues that depend on payments by direct or indirect users.
- **Public perception:** Perception of the public that tax-payer money is transferred to profit-driven enterprises or the perceived misuse of taxpayers' money. The public also perceive that the only way the private operator can make a profit in PPP projects is by cutting corners in service quality.

⁷⁴ https://www.researchgate.net/publication/339282036_challenges_faced_by_public-private_partnership_in_improving_service_delivery

⁷⁵ https://www.researchgate.net/publication/339282036_challenges_faced_by_public-private_partnership_in_improving_service_delivery

Regarding the challenges facing local governments when undertaking PPP projects, the issues are essentially very similar to those of the national government. Because of their smaller size and project value, they may be much less complicated to implement. However, due to serious capacity and resource constraints of local governments in most developing countries and their limited ability in leveraging policy options, PPP projects by local governments are not very common in most developing countries⁷⁶. Accordingly, the need for a sub-national legal and institutional framework for PPPs is more pressing.

3.2.2 Pros and cons of PPPs in Africa

The growth in PPPs has been attributed to several reasons, including:

- increased efficiency in project delivery and operation;
- reinforcing competition;
- access to advanced technology and
- reducing government budgetary constraints by accessing private capital.

Although there are many successful PPP projects worldwide, there are also examples of costly failures that have negatively affected development. The question then arises: under what conditions do PPPs create win-win situations as a result of mutual benefits or socioeconomic symbiosis?

⁷⁶ https://www.unescap.org/ttdw/ppp/ppp_primer/64_ppp_projects_by_local_governments.html

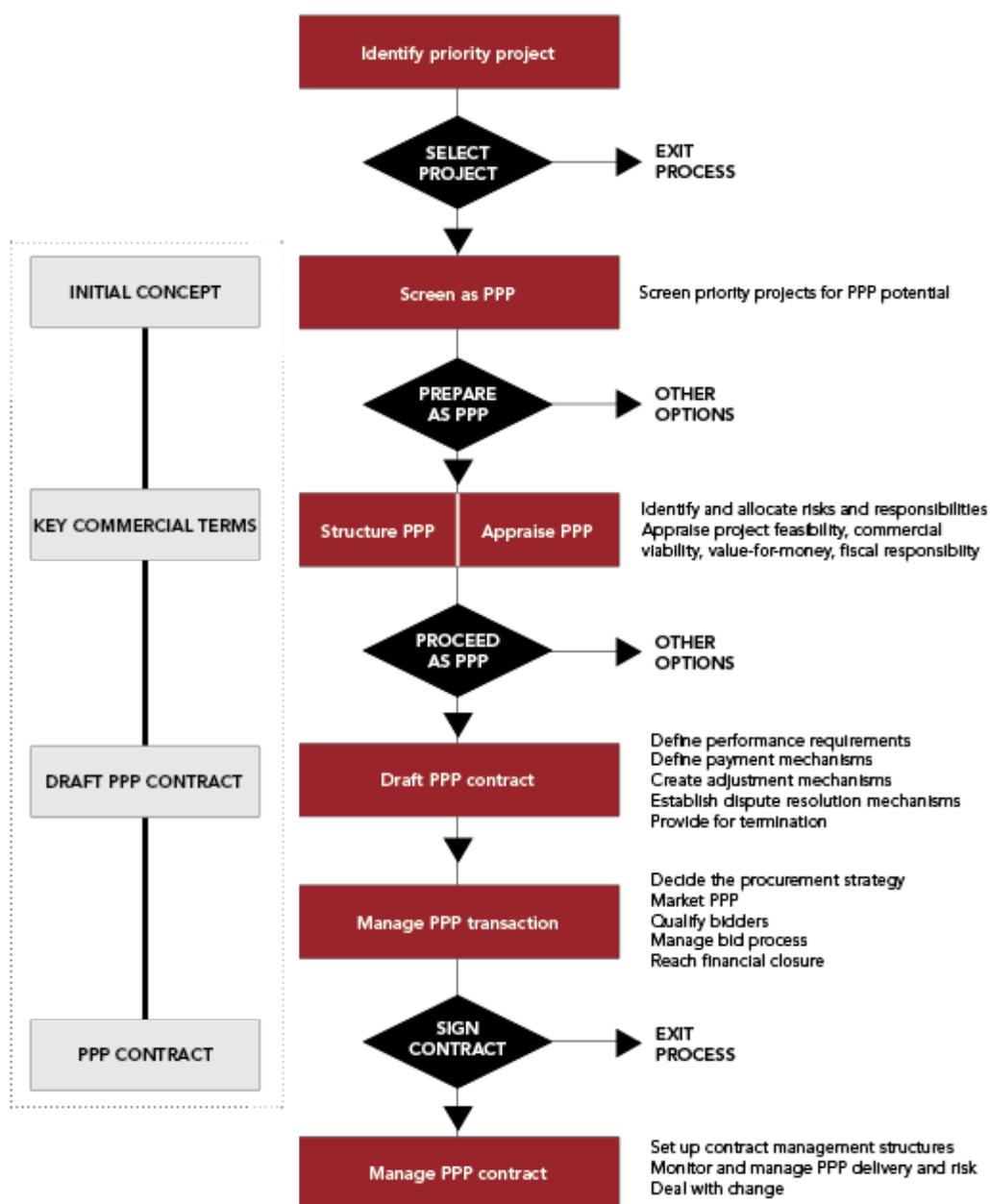


Figure 9: Diagram of a typical PPP process⁷⁷

In Africa, PPPs⁷⁸ are recognized as the most viable policy that can potentially assist with governments underdeveloped infrastructure, technology, and service it is faced with. Various researches and assessments of PPPs in Africa are a combination of good and bad experiences. In some instances, it worked, other times have been marred with complexities. It is therefore imperative that African states do not quickly get tempted by relying blindly on PPP with the assumption that it will be the solution to all financing problems. PPPs have a proven track record of reducing the conflict of full privatization since the government gets a perfect opportunity to deliver crucial amenities and services through the steering of a

⁷⁷ <https://ppp.worldbank.org/public-private-partnership/ppp-process>

⁷⁸ Promoting the solar industry in Ghana through PPPs- <https://www.mdpi.com/1996-1073/15/1/17/pdf> (Dec 2021)

private contractor. At the end of the day, both the private entity and the government should benefit.

African countries such as Ghana, South Africa, and Morocco have all fully benefited from PPPs over the past decades in various sectors of their economies. Major projects in transport, water, agriculture, energy, and health have been swiftly undertaken by PPPs that otherwise would have been troublesome for many African governments, considering the huge infrastructural deficits calculated between USD 130–170 billion per annum. Many researchers believe that PPPs are the roadmap for Africa’s infrastructure facelift, but issues such as corruption, ineffective regulatory framework, undetailed feasibility studies, and overambitious projects must be addressed.

Although positive examples have been established, the mainstreaming of PPPs in climate finance remains limited, and it is clear that continued efforts are required to remove barriers to their deployment. These barriers include: uncertainty about the implementation of the institutional and financial channels established by climate negotiations, high perceived risks with climate projects, particularly in developing countries, and the limited availability of clearly formulated public policies. Cultural differences between public and private financial institutions are also a concern and, from a private sector point of view, PPPs are often perceived to be complex and offer limited profitability.

Public authorities hold an important responsibility to establish frameworks suitable for PPPs to deliver climate finance services. PPPs require policy and market conditions that embrace both public and private interests. These interests depend on country contexts, legal and regulatory conditions, existing service delivery infrastructures as well as on the maturity of financial markets. Figure 10 below presents an overview of central components of PPP frameworks⁷⁹.

⁷⁹ <https://norden.diva-portal.org/smash/get/diva2:915864/FULLTEXT01.pdf>

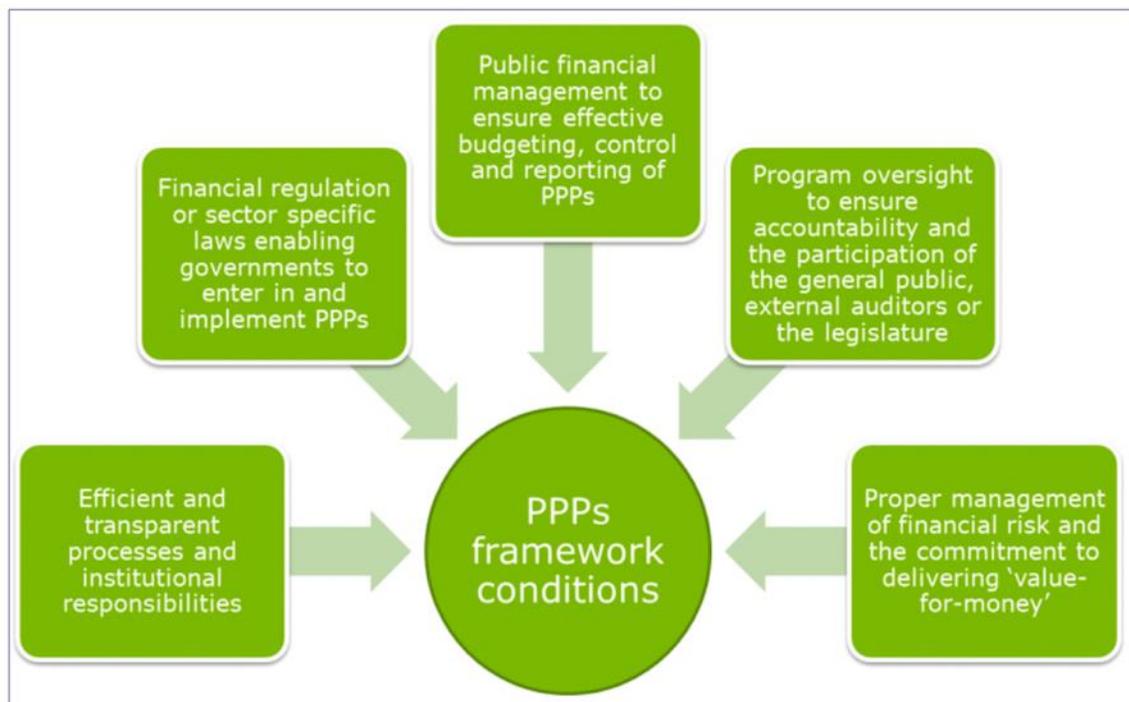


Figure 10: Important components of PPP Frameworks⁸⁰

3.2.4 Examples of solar PV projects through PPPs in Africa

3.2.4.1 Morocco

Morocco⁸¹ is leading the way in the development and generation of renewable resources. The country's renewable energy has currently 3,950 MW installed capacity of renewable energies which accounts for more than 18% of the electricity mix. The country boasts of the planet's largest concentrated solar plant (CSP) at 580MW, the highest capacity in the continent. Located in the Drâa-Tafilalet region, the Ouarzazate Solar Power Plant is part of the Noor Solar Plan that consists of various CSP and PV projects⁸². The Moroccan Ouarzazate solar project illustrates how PPPs can serve effective renewable energy project development under public leadership.

The Moroccan Agency for Sustainable Energy (MASEN), has until now implemented various steps of the Noor Solar Plan solely through PPPs. The plants are developed through the formation of a PPP between MASEN and a competitively-selected private-sector developer for each plant.

⁸⁰ <https://norden.diva-portal.org/smash/get/diva2:915864/FULLTEXT01.pdf>

⁸¹ https://energycapitalpower.com/renewable_races-the-african-countries-leading-the-way-to-a-more-sustainable-future/

⁸² <https://www.mem.gov.ma/en/pages/secteur.aspx?e=2>

Public-private partnerships have been adopted by Morocco since 1997 with BOT arrangements which have helped the solar sector to speedily augment efforts being made to cut down over dependence on other nations for its energy needs. To show full acceptance and understanding, the Moroccan government adopted a law in 2014 that governs PPP operations, thereby boosting investor confidence and indicating the readiness of the government to mutualize agreements with the private sector.

In Morocco, PPP agreements are given different attention than regular public facility management as they are seen as a fit solution for delivering energy projects more efficiently and financially competitive. Transparency, accountability, and standardization are basic benchmarks in Morocco.

3.2.4.2 Djibouti

The construction of the Grand Bara solar power plant⁸³ was approved by the government of the Republic of Djibouti, following the adoption of a preliminary assessment of the project. The project will be developed, built and operated by the French energy company Engie, on a PPP basis, following a framework agreement signed with the government of Djibouti, through the country's electricity utility *Électricité de Djibouti* mid 2020.

Upon completion, this phase, which is part of a much larger project to construct a 300 MW solar complex. With the entire project, the government of Djibouti aims to increase the country's power supply in order to meet its electricity demand and reduce its electricity imports, particularly from the neighbouring republic of Ethiopia that currently supplies 80% of the electricity used in Djibouti.

The project is also in line with the country's sustainable and social development objective to consume electricity generated from renewable sources.

3.2.4.3 South Africa

South Africa⁸⁴ is a leader in the development of renewable energy, with a wealth of renewable energy resources such as solar PV and CSP. The PPP framework adopted by the government has been the bedrock to the successful execution of projects in South Africa. The private sector feels safe investing in the country. The substantial progressive experiences gathered by both the public and private sectors make PPP more stable and accepted. South Africa has developed non-politically community-based PPPs to help

⁸³ <https://constructionreviewonline.com/news/djibouti-approves-construction-of-grand-bara-solar-power-plant/>

⁸⁴ <https://www.solarfeeds.com/mag/biggest-solar-projects-in-south-africa/>

augment bigger projects. Efforts are made to make procurement procedures as transparent and accountable as possible, thereby building trust.

The De Aar Solar farm project is a PPP between Solar Capital and the South African state-owned energy company Eskom utilities. An open bidding process was followed and Solar Capital emerged as the most competitive bidder for both phase one and two of the project. A viable procurement structure (REIPPPP) (“South Africa’s Renewable Energy Independent Power Producer Procurement Programme”) was adopted to follow a transparent approach to the deployment of the project.

It is the largest solar farm in South Africa and Sub-Saharan Africa⁸⁵ with a generating capacity of 175 MW. The project site spans 473 hectares and has more than half a million modules that convert sunlight into power.

Maintenance of the project, ensuring value for money, and maximum returns on investment are equally crucial. Therefore, Arup has been in partnership with Solar Capital to help with the construction and maintenance of this project and ensure that the necessary returns on investment are recouped. This competent hand gives some level of assurance and certainty that this project will be sustained through its lifetime and perform efficiently. All these key indicators make the De Aar project one of the most successful in the world and worthy of emulation.

3.3 Lessons learnt from PPP implementation

The following provides some lessons that can be drawn from a selection of case studies of PPPs in Africa published by the Uongozi Institute in Tanzania⁸⁶. These lessons are also based on the AfDB report focusing on the Utilization of the PPP Mechanism⁸⁷.

3.3.1 General

1. **PPPs versus public procurement:** PPPs are perceived as complex to procure, whereas conventional public procurement is quicker and simpler. However, a carefully-structured PPP procurement is often likely to produce a better result. Moreover, a PPP can be delivered quickly when the government’s budget is too tight for an immediate public procurement.

⁸⁵ https://www.solarfeeds.com/mag/biggest-solar-projects-in-south-africa/#De_Aar_project-175MW

⁸⁶ https://uongozi.or.tz/wp-content/uploads/2017/03/Public-Private-Partnerships-in-Sub-Saharan-Africa_Digital_FINAL-4.pdf

⁸⁷ <https://idev.afdb.org/en/document/afdb-utilization-public-private-partnership-mechanisms>

2. **Political support:** It is essential for a PPP programme to have strong political support, as well as the consensus of opposition parties. As PPP projects tend to involve different public actors, political cohesion and commitment is crucial to ensure a successful project supported by all stakeholders.
3. **Political interference:** Governments should resist the temptation to interfere with a PPP project—for example, putting pressure on a toll-road concession not to increase its tolls even though this is allowed in the concession's agreement.
4. **Sectoral reform:** A PPP project does not exist in isolation, and may face difficulties if the sector in which it operates is not soundly based.
5. **Capacities:** An asymmetry of capabilities between the private sector and public actors is noticeable. Public authorities must engage in capacity building to gain relevant expertise.
6. **Learning:** As Benin lacks experience in managing PPP projects, learning from other procurement organizations with experience in this sector should be encouraged. It is also favourable to consider tapping into local knowledge and presence to capitalize on local expertise and resources.

3.3.2 Project structuring

1. **Affordability:** Government budgets can be predicted for only a relatively short term, but a social-sector PPP needs to be paid for over a prolonged period. Longer planning periods may be needed during the CDP development and resource allocation.
2. **Risk transfer:** The transfer of risk to the private sector is a key element of PPPs. But all risks can never be completely transferred, since the private sector will take on only the risks it can control, such as construction, but not those it cannot control, such as land acquisition for a new road. Sufficient capacity within governments needs to be installed to appropriately manage this risk, as well the project as a whole.

3.3.3 Procurement

1. **Governance:** PPP procurements require an appropriate governance structure to fully realize the potential of PPP projects. Sound governance can ensure providing strong policy rationale for PPPs. However, an adequate legal framework (addressing issues such as vires, step-in rights, compensation on termination etc.) is a necessary, but not sufficient, prerequisite. Different elements of institutional infrastructure have to be in place for PPPs to succeed: strong watchdogs and regulators, a robust system of audit, support, good advisors, a banking system that is prepared and a

public sector that has bought-into the concept and is working to become a smarter procurer.⁸⁸

2. **Pre-qualification:** This is usually necessary in a PPP procurement because the investor group has to include parties with financial capacity and a track record of undertaking PPPs successfully.
3. **Unsolicited bids:** The success rate of PPPs derived from unsolicited bids is quite low and should be avoided if possible.

3.3.4 Finance

1. **Currency risk:** Most PPPs generate revenues in local currencies, but typically (with the exception of South Africa and perhaps Nigeria), local financing markets cannot provide the long-term finance required. Exchange rate insurance is a potential option to mitigate this.
2. **Interest rates:** During the lifetime of a PPP project, interest rates could fluctuate and a high increase could have an adverse effect on the feasibility of the project. Interest rate guarantee, futures, options and swaps are all mechanisms that can mitigate this risk.

3.3.5 Impact of different phases

1. The project preparation should be guided by strong and detailed feasibility studies for PPPs at the initial preparation stages to minimize possible deviations from financial, economic, and social projections with respect to project outcomes.
2. The construction phase is usually the high-risk phase of a PPP. Monitoring is however essential throughout the operational phase of the PPP contract to ensure that a PPP produces the required outcomes.
3. Budgets, staffing (probably including the continued employment of external advisers for some years) and training all need to be organised by the public-sector side well before the negotiations are complete, to ensure a smooth transition.
4. PPP assets usually remain in the ownership of the private sector throughout the term of a PPP contract, however at the end of the PPP contract the infrastructure asset needs to be returned to the public-sector control. Appropriate provisions are needed in the PPP contract to ensure that the asset is returned in a well-maintained condition.

⁸⁸ EIB PPP Review

3.4 Existing PPP policy framework for energy access projects in Benin

This section provides an overview of Benin's policies enabling PPPs in energy access, as well as examples from other African countries. It includes:

- An inventory of existing energy/solar PPP models in Benin
- An assessment on enabling conditions and policy instruments for solar PV PPP and carbon trading in Benin

3.4.1 PPP legislation in Benin

The long-awaited legal framework on PPP was passed by Benin's government in October 2016⁸⁹. It provides Benin an instrument to improve relations between public authorities and the private sector. This legislation fills a large gap in Benin's legal framework for investments. This framework is expected to create and maintain confidence between the private and the public sector, which is essential to create a conducive business environment. This should help unlock investment from both national and foreign investors and will help Benin tackle its challenges in terms of road infrastructure, energy, agriculture, telecommunications and social community.

The Benin PPP Law (Law No. 2016-24 of June 28th, 2017) sets up the legal framework of the PPPs in the Republic of Benin. The law aims to determine the fundamental principles for the conclusion of PPP contracts. To establish the legal regime for the conclusion, execution, terms, control and termination of PPP contracts, the Benin PPP Law has five decrees that have been implemented⁹⁰:

1. Decree N 2018-028 of January 31st, 2018 related to the ad hoc commissions in charge of PPP procurement procedures,
2. Decree N 2018-156 of May 2nd, 2018 creating the "*Cellule d'appui aux PPP*" (PPP Unit)
3. Decree N 2018-039 of January 31st, 2018 related to the control and regulation of PPP procurement and operation;
4. Decree N 2018-424 of September 19th, 2018 that set up a PPP catalogue
5. Decree N 2018-360 of 31st July 2018 that defines the tax regime of PPP contracts

⁸⁹ <https://www.infrappworld.com/news/benin-approves-ppp-law>

⁹⁰ <https://bpp.worldbank.org/economy/BEN>

3.4.1.1 PPP Support Unit

Article 5 of the PPP Law sets up the institutional framework of PPP contracts which include the PPP Support Unit (CAPPP), while contracting PPP missions are detailed in the PPP Unit Decree No. 156 of May 2nd, 2018.

Pursuant to article 4 of PPP Unit Decree, the PPP Unit:

- Advises the government on all matters relating to PPPs;
- Provides assistance to public authority in the process of PPPs;
- Reviews PPP project documentation (making feasibility studies, contract etc.) and issues an opinion;
- Setting up a PPP catalogue;
- Promoting best PPP practices;
- Issuing an opinion on the socio-economic studies and externalities and feasibility studies;
- Assisting in the contract award process; and
- Supporting the relevant organisations in the management of contract enforcement.

Article 6 of the PPP Law provides that the Council of Ministers is the supreme decision-making body in the implementation process of PPP projects. The Council of Ministers deliberates on the decision to use a partnership contract for the implementation of projects that may be subject to it; it approves the preparatory steps and authorizes the signature of the contract.

According to section 6.2 of the PPP guide, the continuation of the process is subject to the approval of CAPPP. For contract partnerships and concessions involving public funding, the continuation of the process is also subject to the agreement of the Council of Ministers on advice of the Minister of Economy and Finance. In this case, the request to continue is introduced by CAPPP.

Pursuant to Article 91 of the PPP Law, signed contracts are sent by the national direction controlling public procurement contracts for approval to the Ministry of finance for the state contracts. Non-approved contracts are considered void.

The Decree No. 2018-424 of September 19th established a catalogue of projects to be realized through PPP (art. 1 and 2). A list of PPP projects is annexed to this decree which is updated every year.

Article 12 of PPP Law require four studies for any PPP:

- Feasibility studies;
- Social and environmental studies;
- Comparability of externality and advantages and inconveniencies;
- Sustainability studies.

Article 13 of the PPP Law provides that the feasibility, environmental and social impact, externalities study and budgetary sustainability studies are carried out by the contracting authority with the assistance of the PPP Support Unit (CAPPP). The feasibility study must in particular indicate the reasons for the decision and the economic, financial, legal and administrative matters that lead the contracting authority to initiate the procedure for the award of such a contract. The feasibility study must also include a comparative analysis of different options, including overall cost, risk sharing and performance, as well as an analysis of the environmental consequences of such a project and its impact in terms of sustainable development. Additionally, section 3.2.1. of the Guidance Note requires a socio-economic and externalities study to be prepared.

3.4.2 Barriers to implementation of PPPs in Benin

As of 2017, the majority of PPPs in Benin are financed by the state through its own resources or through grants offered within the framework of a bilateral or multilateral partnership. PPPs lead to soft debt which has consequences for public finances: rigidification and high cost of debt, high exchange rate risks and overestimation of investment capacities and wrong prioritisation. There are several financial impacts, such as:

- asymmetric allocation of projects to large, usually foreign, companies in developing countries, and the opacity of contracts,
- high transaction costs (negotiation, information asymmetry etc.),
- insufficient legal framework and, above all,
- the lack of awareness from some concerned stakeholders who may use PPPs.

Potential adopters of PPPs such as local governments should also be aware of the management of social change such as the transfer of public labour to the private partner, resistance from consumers who have to pay a higher and sometimes heavy royalties, public appropriation of land associated with population displacement, information asymmetry in favour of the private partner etc. These issues need to be reviewed, anticipated and resolved by the institutional set-up and implementation of a PPP contract.

3.4.3 Potential and existing opportunities

Common to other African countries, Benin aims to close a significant infrastructure deficit. This challenge is coupled with an increasing demand due to rapid demographic changes, the necessity to realize both Agenda 2030 and 2063. It is estimated that Benin requires a significant increase in public spending to bridge the infrastructure gap while achieving the Sustainable Development Goals—about 21% of GDP in 2030. In the electricity sector, providing universal access to affordable, reliable, clean and modern electricity services by 2030 will require considerable investments. The annual cost to reach universal access in Benin is estimated at 2.4% of GDP⁹¹.

In light of the above pressure on the central government, there is a growing concern that the public sector alone will not be able to fund the gaps in public infrastructure and services, even with the help of foreign aid (Foster and Briceño-Garmendia, 2010), which has been dwindling over the years. Several multilateral institutions have called for African countries to turn to the private sector as a possible solution in meeting the shortfall (Loxley, 2013). There is a widespread perception that the involvement of the private sector has the potential to close the gaps on investment, capital, technology, and know-how needed to improve efficiency and delivery of required public infrastructure and services (PPIAF, 2015). This has in turn driven the call for a stronger PPPs approach between the governments and private firms.

In the light of a substantial momentum and a strong political will from the GoB, PPPs are expected to accelerate the realisation of Benin's main development plans, the Programme d'Actions du Gouvernement and the Plan National de Développement (PND, 2018–25). This ambition is manifested by the efforts made to provide a stronger and clearer supporting regulatory framework regarding PPPs. The creation of the PPP support unit is another in addressing capacity weaknesses in planning, negotiating, implementing and monitoring successful PPP projects.

Benin has also started to benefit from a growing experience with PPP projects allowing it to strengthen the skills of its institutions and install a mutual trust between the public and the private sector. This growing attraction by the private sector is also due to relative political stability. Benin is a stable democracy. Patrice Talon was re-elected for a second five-year presidential term in April 2021, and the government currently enjoys an absolute

⁹¹ IMF Working Paper - The Spending Challenge for Reaching the SDGs in Sub-Saharan Africa: Lessons Learned from Benin and Rwanda

majority in Parliament with 83 deputies.⁹² Benin enjoys a stable economy as well—growth improved in 2021 to 7.0% from 3.8% in 2020 stemming from a 17% increase in investment, with a continued countercyclical fiscal policy. Public debt was 47.2% of GDP in 2021 against 46.1% in 2020, but the risk of debt distress remains moderate.⁹³

3.4.4 Examples of PPPs in Benin

Benin has started using PPP agreements to implement some projects related to the development of its infrastructure since early 2010s. These types of contracts are particularly used in the area of public service provision. By 2016, the most common types of PPPs were concessions (Cotonou Port Authority for water supply), leasing (water supply for hospitals) and PPP contracts in agriculture. In 2016, several PPP projects were launched by the GoB, including two energy projects: the construction and operation of a 120 MW dual-fuel thermal power plant on the Maria-Gléta site and the contract for the supply of 60 MW to SBEE and opening of negotiations for the installation of a 150 MW dual fuel power plant⁹⁴.

3.4.4.1 Construction of four solar PV plants, 50MW

The GoB, through the Ministry of Energy and the Ministry of Economy and Finance signed a concession agreement with a consortium formed by French IPP GreenYellow and Egnon Consulting, a Cotonou-based company. The project is financially supported by the International Finance Corporation (IFC) and Proparco, a branch of the AFD.

The PPP is for the construction of four solar PV plants with a combined capacity of 50 MWp, with work to start in 2023. The largest of these, with a capacity of 15 MWp, will be located in Parakou, in the Borgou division. The Bohicon solar power plant, with a similar capacity, will be located in the Zou department.

With a capacity of 10 MWp each, the other two solar power plants will be built in Djougou in the Donga division and in Natitingou in the Atakora division in northwest Benin. GreenYellow and Egnon Consulting were selected through a competitive bidding process in partnership with the Millennium Challenge Account-Benin II (MCA-Benin II).⁹⁵ The electricity

⁹² <https://www.worldbank.org/en/country/benin/overview>

⁹³ <https://www.afdb.org/en/countries-west-africa-benin/benin-economic-outlook>

⁹⁴ <https://www.caa.bj/programme-d-actions-du-gouvernement/energie/centrale-maria-gleta/>

⁹⁵ <https://www.afrik21.africa/en/benin-greenyellow-and-egnon-win-construction-of-4-solar-parks-in-ppp/>

produced by the project will be sold to the SBEE under a 20-year power purchase agreement.

3.4.4.2 Largest solar power plant in Benin (Illoulofin, Municipality of Pobé)

On 19 July 2022, a 25 MWp solar PV power plant was inaugurated in the Municipality of Pobé. The SBEE commissioned Eiffage Energie Systèmes and its subsidiary RMT, to build a solar PV power plant and a high-voltage bay to connect it to the national electricity grid. The plant's capacity will be increased to 50 MWp by 2023 thanks to the support from the AFD and the European Union. Called Defissol, the project to build the Onigbolo power plant is co-financed by the EU, the AFD and SBEE. It should enable Benin to reduce its energy bill, while making the most of renewable energy.

This photovoltaic plant is projected to produce 35 GWh of electricity per year to cover the energy consumption of 180,000 people. A flagship project of the Government Action Programme (PAG) orchestrated by the President of the Republic of Benin, Defissol is expected to reduce the country's CO₂ emissions by 23,000 tonnes per year (or 575,000 tonnes over 25 years, i.e. the estimated lifespan of the installations).

4 Overview of carbon market mechanisms and opportunities in Benin

4.1 Introduction to carbon markets

Carbon markets are touted as an important tool to reach short- and medium-term greenhouse gas (GHG) emissions mitigation goals. Article 6.2 of the Paris Agreement⁹⁶ creates the basis for trading in GHG emission reductions (or “mitigation outcomes”) across countries. In addition, they have the potential to reduce costs of carbon dioxide abatement. Carbon credits are created and traded through carbon markets, with one carbon credit reflecting one tonne of carbon abated. With this mechanism, public and private actors can meet their climate change targets by purchasing carbon credits, should they not wish to achieve these goals through their own means. Conversely, entities who are well on track to meet their emissions targets can sell these carbon credits and stimulate investments.

Carbon markets give governments and private sector entities a platform to transition in a cost-effective manner, and supports the achievement of net-zero emissions goals. Voluntary mechanisms currently account for the bigger share of the global carbon market. An evolution in the carbon market is not only increased trade in carbon dioxide emissions, but the development of “Energy Attribute Certificates”. In this case, the energy source has a value, and large global corporations—with significant global commitments—drive the purchases of these energy attributes. As private sector players they would want to own the energy attributes (multi-benefits) as an offset.

⁹⁶ https://unfccc.int/sites/default/files/english_paris_agreement.pdf

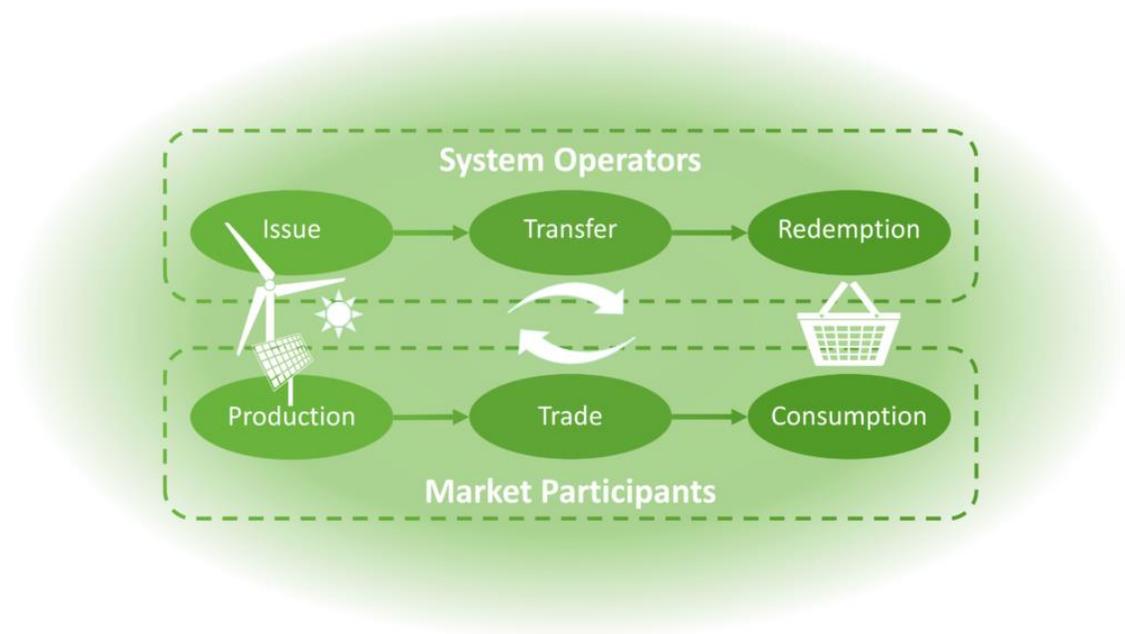


Figure 11: Diagram of the AREC Facility⁹⁷

4.2 Carbon market potential in Africa

The Paris Agreement further allows countries to cooperate with each other through an international carbon market. Robust and transparent accounting systems need to be established to avoid double counting, as well as ensure the accurate pricing of carbon credits for an international carbon market to have its desired effect.

African countries, in general, have not yet played a role in carbon markets, primarily due to a lack of skills and technology to establish accounting frameworks⁹⁸. This is unfortunate as carbon markets could have a major impact in Africa's low carbon development. The vast forests located in many African countries act as significant carbon sinks. Carbon markets can essentially monetise this absorption of carbon, leading to increased land and forest preservation and restoration. Many African countries overall contribute a very small fraction to global CO₂ emissions, yet need to drastically improve socio-economic conditions for their growing populations. Carbon markets can provide access to resources for much-needed development, whilst ensuring this is done in a low-carbon manner.

⁹⁷ Source: <http://recs.africa/our-work/>

⁹⁸ <https://climatepromise.undp.org/news-and-stories/africa-needs-carbon-markets>

Seeing this opportunity, many African countries are looking to establish carbon accounting frameworks. At a project level, should similar verified carbon accounting frameworks be installed, carbon credits could provide an additional source of revenue for projects and thus helping to improve their financial viability.

4.3 Carbon market potential in Benin

Benin has not yet been very active in carbon markets for the reasons presented in the previous section. Very little work has been done in Benin on the front of establishing carbon accounting frameworks. This should be an area the country should focus on developing in order to take advantage of its carbon market potential. Encouragingly, as part of the government's action programme (PAG 2) for the period 2021–26, Benin stated its intent to make use of carbon financing as a source of resource mobilisation to develop its green economy, to finance its energy transition, and to commercialise its nature assets⁹⁹.

The sectors that could be considered relevant for carbon credit projects in Benin are, similarly to the rest of Africa, forestry and land use (by protecting forests acting as carbon sinks), agriculture, blue carbon, renewable energy (including the deployment of solar solutions to supply electricity), transport (by diverting the use of fossil fuels in transport), household devices, livestock, or waste management. Clean cooking, for projects that aim at switching to highly efficient cookstove, is another potential sector that can be considered for carbon market projects¹⁰⁰.

One of the mechanisms that could be used is the Clean Development Mechanism (CDM), but for instance to evaluate the potential of carbon sink of forests, there is a lack of reliable scientific data on ecosystems and their productivity remains a major handicap for evaluating carbon in order to prepare projects that are acceptable on the carbon market. Another shortcoming is the lack of knowledge and expertise in Benin to submit relevant project for the CDM¹⁰¹.

⁹⁹ <https://www.24haubenin.info/?Le-Benin-se-lance-dans-la-finance-Carbone-pour-un-developpement-durable> – accessed on 24 October 2022

¹⁰⁰ See section 4.5

¹⁰¹ https://www.ecobenin.org/wp-content/uploads/2012/07/pdf_TDR_etude_bilan_carbone_mangroves_EA_EcoBenin.pdf - accessed on 8 December 2022

4.4 Carbon markets in PPPs

As far as climate finance goes, the BEP project pursues the innovative use of carbon credits in PPPs in the solar PV sector. Accounting for carbon credits in this way may support and promote growth in the solar PV sector by developing PPP finance models at local government level, that can include revenues that may accrue from the selling of carbon credits.

Another factor to consider is the public market vis-à-vis the private market. The value attached to energy is not necessarily in public finance. In this case the public sector in the PPP could give the private sector access to invest in a specific sector in the country and give users of the power peace of mind that the power contributes to broader just transition goals. Who becomes the owners of the energy attribute (i.e. carbon credits) is a function of negotiation in the transaction and legal documents of the PPP structure. For example, if undifferentiated power sells at USD 0.50 for a unit of energy, the cost with the carbon credit (energy attribute) might sell for USD 0.70. If the power purchaser then chooses to buy the green power, the government relinquishes ownership of the carbon credits and the private sector owns it (or vice versa).

According to the United Nations Framework Convention on Climate Change (UNFCCC), only one entity owns the credits according to global standardised and aligned indicators. In unpacking the potential of using carbon credits in proposed PPP processes for Benin, it is essential that the private sector, the government and lawyers find a negotiation space and understand the implications of using carbon credits in the financial transaction documents and agreements. It is possible to use carbon credits to stimulate the growth in the PV sector as a lever to bring in the private sector.

The Africa Renewable Energy Certificates Facility¹⁰² is an African-based membership organisation and non-profit initiative with global participation that works for the development, use and promotion of renewable energy certificate (REC) systems and markets in Africa. RECs refer to “transferable and redeemable certificates that disclose information about renewable energy production devices”. This enables the development of market practices, and participants can purchase RECs and claim their associated attributes against different policies¹⁰³.

¹⁰² <http://recs.africa/our-work>

¹⁰³ <http://recs.africa/about/> - accessed on 27 June 2022

Governance structures and principles that build capacity and ownership of the development and operation processes of carbon trading are desperately needed in many African countries. Market-facilitating REC institutions at a local and regional level in order to create meaningful and effective policy interaction on the continent should also be created.

4.5 Analysis and examples of carbon market projects in Benin

During the stakeholders meeting that took place in August 2022 in the framework of the BEP project, two carbon market projects were presented. They are the only examples identified in Benin by the authors of the report.

The first project is the project *Wanrou*¹⁰⁴ of the NGO Eco-Benin. The project aims at developing new, improved and efficient cookstoves technologies. It further aims to produce and provide them to rural populations in northern Benin to replace traditional three stone cookstoves, thus reducing GHG emissions and deforestation while improving the health of the community. The project is the first to benefit from carbon credits in Benin, particularly to develop and produce the cookstoves. The main sponsor of the project is Interparking, a European car parks company, which aims to compensate for its climate impact by financially supporting several programmes such as *Wanrou* that contribute to a reduction of CO₂ emissions.

The project contributed to the development of new components for improved cookstoves adapted to the context of northern Benin and to standardise the households' equipment. Around 13,852 cookstoves were built in 5,600 households, contributing to a reduction of respiratory illnesses and burn injuries, a 50% reduction in cooking time, 50% savings on the purchase of wood per family per month, 2 tons of timber saved per family per year, while avoiding 3 tons of CO₂ emissions per household per year and saving 36,000 trees per year.

The other project, *Aire Communautaire de Conservation de la Biodiversité de la Bouche du Roy* (Biodiversity Conservation Community Area) in the south of Benin, aims at restoring mangrove forests in the area. From 2013 to 2020, Eco-Benin and its partners initiated a series of studies to: (i) establish a carbon footprint showing the quantification of the actual carbon stock in the reserve (ii) study the feasibility of developing a carbon finance project (iii) establish the reference for the development of a Carbon Mangrove project. The results

¹⁰⁴ <https://www.wanrou.org/#introduction> – Accessed 8 December 2022

of all these studies show that the mangrove ecosystems of the Bouche du Roy have a very high current and future potential to act as a carbon sink, reaching 8 to 12 tons of CO₂/ha/year.

The project benefited from funding from the Australian government through the Blue Carbon Accelerator Fund coordinated by the International Union for Conservation of Nature (IUCN) to implement the project. Some of the long-term objectives and actions developed in the framework of the project include:

- raising community awareness of the Blue Carbon project;
- developing a feasibility study to assess mangrove conservation and restoration activities in the project area as a potential REDD+ project;
- increasing the tons of CO₂ sequestered and/or avoided;
- extending of the mangrove ecosystem per year to 8,000 ha by 2025;
- planting 900 ha of mangroves by 2025.

The ultimate goal of Eco Benin's mangrove carbon project is to enter the CDM through the planting of mangroves in the wetlands of southern Benin.