



REPUBLIC OF BENIN
Fraternité – Justice – Travail

**MINISTRY OF ENERGY, OIL AND MINING RESEARCH, WATER AND
DEVELOPMENT OF
RENEWABLE ENERGY**

Directorate General for Energy



**EXPRESSION OF INTEREST OF THE
REPUBLIC OF BENIN IN THE CIF/SREP
PROGRAM**

YERIPAO DAM



APRIL 2014

EXPRESSION OF INTEREST OF THE REPUBLIC OF BENIN IN THE CIF/SREP PROGRAM

I. Country and Government Agency submitting the Expression of Interest

Country: Republic of Benin

Government Agency: Directorate General of Energy / Ministry of Energy, Mining and Oil Research, Water and Development of Renewable Energy

II. Description of the Country's situation and of the Context of the Energy Sector

2.1. Basic Data of the Country

2.1.1. Geography and Population

Located in West Africa between Nigeria to the east, Togo to the west, and bordered to the south by the Atlantic Ocean and to the north by Niger and Burkina Faso, Benin covers an area of 114,763 square kilometers.

The growth rate of the Beninese population (3.25%) is at the origin of several challenges in social demand (nutrition, education, health, employment, housing and urban management), and the availability of production factors. More than 50% of the population is under 18 years. Life expectancy at birth is 61.1 years, slightly higher for women 63.2 years against 58.9 years for men. The active population (15-64 years) is 50% of the total population. Nearly 60% of the population lives in rural areas.

2.1.2. Economic Data

The growth of Beninese economy was slow, low and insufficient (3.8%) to meet the social demand caused by rapid population growth. This imbalance between population growth and economic growth increases the level of poverty. The poverty rate in 2011 was 36.2% and the development index stands at 0.436. The economy is characterized by the predominance of primary and tertiary sectors. The secondary sector is still embryonic. It is part of several sub regional economic areas, including West African Economic and Monetary Union (WAEMU) and the Economic Community of West African States (ECOWAS).

2.2. Energy Sector

2.2.1 General Overview

The national context appears a national relatively low energy consumption, marked by a predominance of traditional uses of biomass energy: Energy consumption in Benin is of 3344 ktoe in 2010, representing 0.392 toe / capita. This energy consumption is far lower than the world average of 1.7 toe.

Consumption of firewood and charcoal represents about 49.5% of total final energy consumption in 2010, petroleum products 48.3% and electricity 2.2%.

Energy consumption structure by sector dominated by households and transport: By sector of activity, the structure of energy consumption is marked by a predominance of the household sector (53%), followed by transport (36%) because of the consumption of petroleum products, and services sector (9%). Energy consumption in the industrial sector remains the lowest (2%) because the limited development of the industrial fabric.

Low access rates to electricity, especially in rural areas: In 2012, the national electrification rate is of 28.2% with 54.9% in urban areas and 4.5% in rural environment. The coverage rate is of 41.6% in 2013. Electricity consumption per inhabitant which is also very low is of about 110 kWh / inhabitant / year.

A strong dependence on energy from the outside: Benin is heavily dependent on external sources for its energy supply. 100% of consumed petroleum products are imported; Benin does not yet have an oil refinery. 90% of the electricity consumed in 2012 comes from the outside.

Electricity: A Poorly Developed Sub-Sector: Benin has a low capacity for production of electric energy, which indicates its high dependence on neighboring countries (Ivory Coast, Ghana and Nigeria) to satisfy electricity needs. The electricity supplied to consumers is subject to problems of load shedding that occurred for more than 50 days in 2012. Currently, the deficit in the supply of electric power is about 50 MW. In fact, the average demand is 190 MW in 2012 while the supply of available electricity hardly reaches 140 MW. In 2013, peak demand reached 210 MW.

2.2.2 Potential of the Energy Sector

Based on the potential sources of recoverable renewable energy in Benin, it is possible to set minimum targets of 25% of renewable energy in the national energy mix by 2025. This can be achieved by the development of potential bioenergy, hydro, solar and wind energy.

Bioenergy Potential:

- **Garbage:** They exist in large cities in significant quantities and their recovery should be considered for the development of capacities for electrical energy production to be injected into the supply network. The value in developing this sector involves various fields as energy, economy, health and environment. According to studies by the City Hall of Cotonou, the city would generate more than 700 tons of garbage per day.
- **Residues of food processing:** Food processing plants producing cottonseed or palm oil release significant quantities of waste (hulls and cottonseed, palm or coconut husk and meal, etc...) which constitutes true energy potential. Companies such as FLUDOR, SHB installed in the Bohicon area already have plans to do so for a capacity of around 6 MW.
- **Biofuels:** the strategy for the promotion of biofuel chains in Benin was adopted by the Government in April 18, 2012. According to this strategy, Benin is expected to produce 1.15 billion liters of ethanol and 229 million liters of biodiesel by 2025 to cover the domestic market with a blend of 10% with gasoline and diesel, and replace 15% of wood energy in households with ethanol.

Hydropower potential:

Hydropower potential is rather significant. It is likely to be valued for increasing national capacity of electricity production, both for the development of hydropower plants of large, medium and small capacity and for building micro-hydro plants in rural areas. The 1992 study by Coyne & Bellier on Ouémé River revealed, inter alia, that the two (2) sites below may be subject TO hydroelectric developments. These sites are Bétérou Amont (23.2 MW, 70 GWh) and Olougbe Ter (29.5 MW, 72 GWh).

Other studies have revealed that Benin has many other sites that may be developed to house small hydroelectric dams namely for power less than or equal to 1,000 kW. Among these sites, six (06) were the subject to a feasibility study for their development. The characteristics of these sites are shown in the table below.

Table 1: Characteristics of the two sites suitable for micro-hydroelectric dams

Name of the site	Annual production Capacity (GWh)	Installed Power (kW)	Overall cost of investment (\$)	Main Characteristics
Cascade de Sosso	2,9	494	7 185 210	Out of the six study sites, Zanolua has the most important producible capacity. It also represents the highest total investment cost. This micro-plant has two functions. It first supplies the entire village of Fouay and then provides the rest of its capacity to the national network
Gbassé	2,6	450	6 487 880	The site of Gbassé represents the second most important investment. The main objective of this micro- plant is to supply the national network. Therefore the entire production of the site is dedicated to strengthening the network.
Koutakrouk rou (Iranè)	0,36	60	2 434 077	The main objective of this micro- plant is to supply the national network

Name of the site	Annual production Capacity (GWh)	Installed Power (kW)	Overall cost of investment (\$)	Main Characteristics
Chute Kota	0,18	45	1 261 000	The Kota site has the lowest investment cost compared to the potential production.
Ouabou	0,54	130	2 506 699	This micro- plant supplies the villages of Ouabou and Tectibayaou and injects the rest of its capacity to the national grid
Kouporgou	0,26	60	2 506 699	The micro- plant is stand alone and supplies electricity to isolated villages

Solar Potential:

The average sunshine in Benin varies between **3.9 kWh / m² / day in the south to 6.1 kWh / m² / day** in the North. The sunshine is higher in the north of the country than in the south.

The regional ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREE) developed a mapping of solar and wind energy resources in the 15 ECOWAS countries (Economic Community of West African States) including Benin.

Wind energy potential:

Wind speed measured at an altitude of 10 m varies from 3 to 5 m / s. However, there are more favorable areas in the northern region, in the center of country and in the southern region, that are likely to host wind turbines. In this context, it is necessary to perform a measurement campaign lasting at least one year on the most favorable sites at an altitude ranging between 40 and 60 meters. The wind map produced by ECREE provides an overview of the windiest areas.

II.2.3 Enabling environment for renewable energies

One of the objectives of government policy in the energy sector is to increase the production capacity of electric power in order to achieve a self-sufficiency of 70% by 2025, partially based on renewable energies. To demonstrate the commitment of Benin to the promotion of renewable energy, the Government enacted Law No. 2012-11 of 26 January 2012 authorizing the ratification of the Statute of the International Renewable Energy Agency (IRENA). In this context and to serve as an interface to IRENA created on January 26, 2009 in Bonn, Germany, the Government of Benin decided to create a **National Agency for the Development of Renewable Energy and Energy Efficiency (ANADER)** whose implementation is expected during this year (2014).

The vision of this sub-sector is formulated as follows: "Making renewable energy and energy efficiency, a factor in energy security, economic growth and poverty reduction."

The overall objective of the renewable energy policy is to encourage the development of renewable energy to meet the energy needs of Benin, and to provide equal access to services.

More specifically, the policy has the following objectives:

- Implementing favorable institutional, legal and incentive structures for the development of renewable energy and energy efficiency;
- Developing national capacities for the production of renewable energy and energy efficiency in relation to the private sector;
- Developing and implementing a communication and awareness raising program for the development of renewable energies and energy efficiency in Benin;
- Developing applied research in the field of renewable energy and energy efficiency;
- Enhancing regional and international cooperation in the development of renewable energies and energy efficiency.

III. Enabling Environment in terms of regulatory, legal and tariffs

III.1 Institutional Framework

At the institutional level, the energy sector is organized as follows:

The Ministerial Department responsible for the management of the energy sector and in particular the subsector of renewable energies. It provides guidance for the national policy on energy and supervises all the structures directly involved in the energy sector outside the Regulatory Authority for Electricity.

The Directorate General for Energy (DGE), liaising with other relevant national bodies, proposes the state policy in the energy sector, ensuring its implementation, its monitoring and evaluation.

The Beninese Agency for Rural Electrification and Energy Control (ABERME) implements the state policy in the field of rural electrification and energy control.

The Electrical Community of Benin (CEB) provides import, production and distribution of electrical energy to Benin and Togo.

The Benin Electric Power Corporation (SBEE) provides distribution and marketing of electricity in Benin.

The Agency for the Control of Internal Electrical Installations (CONTRELEC) is dedicated to promoting compliance with the technical requirements for the implementation of domestic electrical installations in order to ensure the safety of persons and of property.

The Authority of Electricity Regulation (AER) its role is to ensure compliance with laws and regulations governing the sub-sector of Electricity, protect the public interest and ensure continuity of service, quality services, the financial balance of the sub- sector and its harmonious development. The regulatory authority, created in May 2013 and placed under the supervision of the President of the Republic is not yet established.

West African Power Pool (WAPP) a specialized institution of ECOWAS in charge of the regional power system aims at the integration of national electricity networks on a unified regional market to ensure medium and optimum long-term and reliable power supply, and a cost accessible to people in the different Member States through the development of cross-border exchanges in electricity.

III.2 Legal Framework

In the sub-sector electricity activities are governed by two (02) laws:

- The Benin - Togo Code of Electricity, bilateral agreement between Benin and Togo since 1968 and revised in 2003 specifically designed to open the sub-sector to independent producers and give the CEB the status of single buyer;
- The Act on the Code of Electricity in Benin adopted on 27 March 2007, which completes the Benin-Togo Code of Electricity and liberalizes the production and distribution of electrical energy in Benin and authorizes the signature of concession agreements with independent power producers.

The regulatory instruments of the electricity sub-sector are essentially the following:

- The decree No. 2009-182 of 13 May 2009 establishing the responsibilities, organization and functioning of the Authority of Electricity Regulation;

- the decree establishing the Rural Electrification Fund (REF);
- the decree on the procedures for granting concessions for electrification

III.3 Tariff Policy

A study on tariff indexation was conducted and resulted in proposals for indexing formulas for electricity tariffs. However, the application of these formulas for tariff indexation is not yet effective.

IV. Rationale for SREP Funding of Specific Sectors

IV.1 Energy Security

The electric power consumption of Benin is highly dependent on external supplies, which exposes the country to frequent power cuts, insecurity and recurrent energy crises.

Domestic production of electrical energy in Benin includes the energy produced by SBEE at the Yéripao hydroelectric plant (0.5 MW), located near Natitingou, and the energy produced by the thermal power plants. The domestic power generation capacity of Benin is still very limited today. Currently, SBEE production plant has an installed capacity of 81 MW. This capacity was recently increased by a dual fuel turbine of 80 MW. However, this domestic production capacity is not always available particularly because of the prohibitive cost of kilowatt-hour.

Today, the sector strategy is directed towards improving the energy independence of the country and diversifying its sources of supply, through the implementation of various interconnection projects with neighboring countries and the enhancement of the national renewable energy potential.

IV.2 Obstacles to the Development of Renewable Energy

The obstacles to the development of renewable energy in Benin are the following:

- the absence of an institutional and legal incentive framework for developers of renewable energy;
- the relatively high initial investment costs of development of different technologies, for both the general public and family facilities;
- the absence of detailed design studies for the production of energy in the sub-sector of renewable energy, including wind, geothermal, and tidal power;

V. SREP Proposed Areas of Intervention

SREP intervention is required to help the implementation of the equipment plan for electricity production from renewable energy sources. This plan is developed based on the demand forecasts, the renewable energy potential available for the projects in the pipeline and the considered facilitations to be granted to private developers within the implemented legal framework.

To help meet energy demand (demand in power and energy) and improve energy security, it is necessary to develop local production capacity, particularly through renewable energy systems.

The equipment plan for the main renewable energy sources is presented in the table below:

Table 2: Projection of capacities to be installed for the production of electricity (MW)

Energy Sources	Description of technologies	Periods			TOTAL
		2015-2020	2020-2025	2025-2030	
Biomass energy	Biomass plants (household waste, agricultural residues ...)	25	50	50	125
Solar energy	Solar kits, mini plants feeding the local network, plants feeding the transport	25	25	25	75

	network, etc.				
Wind energy	Parks of wind turbines on the windiest sites in the country.		5	5	10
Hydropower	Small hydro power plants.	2.0	10.0	10.0	22
TOTAL RENEWABLE ENERGIES					232

Source: Feasibility study for the operationalization of ANADER.

Specifically, SREP support is requested to build the national capacity and strengthen the regulatory framework for a greater involvement of the private sector to support private developers of renewable energy which demonstrated interest in the construction of power plants in Benin and to develop projects for the promotion and development of large scale PV solar kits in remote rural households far from the network. These projects which aim at an increased contribution of renewable energy to domestic energy production and the promotion of an enabling environment for renewable energy are specified in the various areas as follows:

V.1 Project of small hydro power plants:

Project 1: Project for the development of mini and micro hydropower plants in Benin.

It consists in the implementation of projects related to the construction of the 6 small hydroelectric centrals as indicated in the Table 1 above. Feasibility studies are available and the estimated investment cost is 22.4 million USD. The projected installed capacity is 1.24 MW with an annual energy yield expected of 6.84 GWh.

V.2 Solar energy projects:

Project 2: Project to support private developers for the implementation of photovoltaic solar plants

The project aims to support private developers that have demonstrated interest in setting up solar power plants in Benin. Most of these promoters have conducted all feasibility studies and front end engineering designs. The proposed conditions of purchase and sale have so far repelled the promoters that expressed their interest. The project will support two (02) promoters and will pave the way for the development of public / private partnerships in the field. SREP funding will support the investment, the construction of lines to feed the network with IPP production and to mobilize land for the development of solar PV plants.

Estimated cost: €27.25 million.

Projected installed capacity: 10 MWp (Tchaourou) and 6 MWp (Kandi)

V.3 Biomass projects:

Project 3: Project to build a biomass power plant with the private sector

The project has two components:

- Component 1: Support to agro-industry for energy recovery from industrial waste and / or agricultural residues: The oil companies Fluidor and SHB have projects of power plants with a capacity of around 6 MW in the Bohicon area center of the country. There is a need to support the realization of these projects. Estimated Cost: to be specified. Projected installed capacity: 6 MW.
- Component 2: Support for the construction of a power production plant of 5 MW from household waste from Cotonou (Contractor: private sector)

V.4 Wind energy project:

Project 4: Design and development of a wind farm on the coast of Benin.

This project aims to increase the contribution of renewable energy sources, including wind turbines to domestic energy production. It will support one (01) of the developers having expressed their interest and conducted feasibility studies to establish a wind farm on the coast of Benin.

VI. Rationale for the Solicitation of CIF Funds

Notwithstanding the emphasis on the development of renewable energy, there is little use of potential resources in Benin. This low utilization is due inter alia to:

- Initial investment is too high (in relation with the national capacity) and necessary for the development of clean technologies;
- The absence of a specific renewable energy tariff policy;
- The relatively still high cost of energy produced from the said sources and clean technologies (photovoltaic solar energy, biomass plants).

However, by developing alternative, sustainable and national solutions today, Benin will better tackle the energy challenges of the future.

Proposed projects offer the best options for energy production. But investment costs are very high. Concessional loans from multilateral development banks, the contributions of technical and financial partners and grants that may be mobilized under the SREP are necessary for the implementation of the ambitions of the energy sector. The SREP funding will mainly accelerate the infrastructure development of electricity generation from renewable energies. The conditions offered to investors for the development of the first projects will be more advantageous in the context of the SREP. Thus, these projects constitute a lever for development of clean energy technologies.

VII. Economic Performance of the Sector

VII.1 SBEE Performance

The turnover SBEE totaled 104.944 billion CFAF for the year 2012 against 98.030 billion CFAF in 2011, representing an increase of 7.05%. This variation in turnover is mainly due to the increase in the amounts of sold electricity (840.55 GWh in 2012 against 796.24 GWh in 2011).

The value added that measures the increase in value brought by the company in the operation of its professional activities amounts to 29.060 billion CFAF in 2012 against 25.03 billion CFAF in 2011.

VII.2 CEB Performance

Table 3 below presents the financial position of CEB between 2007 and 2011. It should be noted that the sales price of the companies of the Benin Electric Power Corporation (SBEE) and Electric Energy Company of Togo (CEET) is an administered price. Its increase could enable the CEB to ensure its financial stability insofar as the tariff indexation formulas are not yet implemented.

Table 3: CEB performance 2007-2011

Labels	Achievement in million CFA francs				
	2007	2008	2009	2010	2011
Turnover	66 675	71 999	91 314	99 853	114 198
Results	483	3 048	2 182	1 879	-3 672

Source: CEB.

VII.3 Governance in procurement

Governance in public procurement is governed by Law No. 2009-02 of August 7, 2009 concerning public procurement codes and the delegation of public service in the Republic of

Benin. Contracts (works, supplies, services) financed by the project must be awarded in accordance with lessor's guidelines for procurement under loans granted by the project. For international tenders, the project used the lessor's standard documents of tender and models of evaluation report.

The notice of national call for tenders will be published locally. Such notice of national call for tenders must comply with the laws and regulations of Benin on procurement, provided that it is acceptable to the lessor and shall comply with principles of economy, efficiency, transparency and fair competition within the guidelines of the lessor.

VIII. Institutional and Technical Capacities

VIII.1 Institutional Capacity

In the current context, the implementation of programs for the development of renewable energy is conducted by the Directorate General for Energy and ABERME.

However, it appears necessary to implement ANADER as was decided by the Government.

VIII.2 Technical Capacity

The Directorate General for Energy (DGE) has experience in managing projects funded by partners, including the World Bank, providing grants or loans. It has a capacity of acceptable financial management and a solid understanding of the procedures of the World Bank and / or their respective financial partners. In the past, the Government of Benin has received several grants (including from the French Development Agency (AFD), KfW, the European Union, The FGEF, the GEF) for financing energy infrastructure, the management of which has been properly performed by the DGE through PFSE and DAEM projects (Energy Service Delivery Project and Project for the Development of Access to Modern Energy).

The Directorate General for Energy includes in its organization a Directorate for Renewable Energy that coordinates the actions related to renewable energies and rural electrification.

IX. Programs of Multilateral Development Banks and Development Partners

The donors involved in the energy sector in Benin are: IDA, European Investment Bank (EIB), Kreditanstalt fur Wiederaufbau (KfW), the Global Environment Fund (GEF), the French Global Environment Facility (FGEF), AfDB, EBID, BOAD, AFD, GTZ, UNDP, etc...

The programs hereafter were developed with these partners. It is about:

- Increased Access to Modern Energy Project (IAME), with an initial costs of 102,16 billion CFAF financed by IDA (the World Bank), European Investment Bank (EIB), KfW, FEM, FFEM, AFREA, NDF;
- Project of Supply of services of Energy, with a cost of 53,46 billion CFAF financed with IDA (the World Bank), EIB, KfW, BOAD, FFEM, AFREA, NDF;
- Project Facilitated Energy of initial costs of 13,2 billion CFAF with partners DGIS, GIZ/ENDEV, AFD;
- Projects of rural electrification financed by the BIDC, the BAD and the BOAD;
- Construction project of lines of transport of the WAPP (dorsal south 330 kV: Nigeria, Benign, Togo, Ghana) financed by the AfDB and the BM.