



PROJECT IDENTIFICATION FORM (PIF)

PROJECT TYPE: FULL-SIZED

TYPE OF TRUST FUND: GEF TRUST FUND

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PART I: PROJECT INFORMATION

Project Title:	Promotion of sustainable biomass based electricity generation in Benin		
Country(ies):	Benin	GEF Project ID: ¹	5752
GEF Agency(ies):	UNDP	GEF Agency Project ID:	5115
Other Executing Partner(s):	Ministry of Energy and Water; Ministry of Environment; Société Béninoise d'Énergie Electrique (SBEE); Commune of Kalalé	Submission Date: Re-submission Date:	7 March 2014 21 March 2014
GEF Focal Area (s):	MULTIFOCAL AREA	Project Duration (Months)	60 months (5 years)
Name of parent program (if applicable):		Agency Fee (\$):	367,897
• For SFM/REDD+ <input checked="" type="checkbox"/>			
• For SGP <input type="checkbox"/>			

A. INDICATIVE FOCAL AREA STRATEGY FRAMEWORK²:

Focal Area Objectives	Trust Fund	Indicative Grant Amount (\$)	Indicative Co-financing (\$)
CCM-3: Renewable Energy: Promote investment in renewable Energy technologies	GEF TF	1,959,132	6,800,000
LD-3: Reduce pressures on natural resources from competing land uses in the wider landscape	GEF TF	1,000,228	3,500,000
SFM-1: Reduce pressures on forest resources and generate sustainable flows of forest ecosystem services	GEF TF	913,242	4,000,000
Total Project Cost		3,872,602	14,300,000

B. INDICATIVE PROJECT FRAMEWORK

Project Objective: To introduce an integrated energy and ecosystems-based approach to sustainable biomass electricity generation in Benin.						
Project Component	Grant Type ³	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount (\$)	Indicative Cofinancing (\$)
1. Policy, institutional, legal and regulatory framework for biomass electricity generation established	TA	Streamlined and comprehensive market-oriented energy policy and legal/regulatory framework for biomass electricity generation by Independent Power Producers (IPPs)	1.1 Appropriate policy and legal/regulatory framework established and operational for - biomass electricity generation - re-investment of energy proceeds into community conservation (Mechanism for establishment of community trusts in all high residues/biomass potential sites; Benefit sharing schemes established between IPPs and communities for maintenance of ecosystems services) 1.2 Technical report on grid capacity requirements to enable feed-in for	GEF	\$285,000 (CCM) Total= \$285,000	2,000,000

¹ Project ID number will be assigned by GEFSEC.

² Refer to the reference attached on the [Focal Area Results Framework](#) when completing Table A.

³ TA includes capacity building, and research and development.

			<p>grid-connected renewable energy systems followed by development of an updated grid code; as well provision on off-grid / mini-grid options.</p> <p>1.3 Established procedures and standardized PPAs for the introduction of a transparent procurement process in the selection/award of biomass-based electricity supply agreements by private developers</p> <p>1.4 One-stop shop for issuance of construction licenses and permits to private RE developers</p> <p>1.5 Methodology developed for a joint environmental, economic and financial evaluation of biomass plants in line with government regulations and policies</p> <p>1.6 Capacity developed within SBEE, FAGACE⁴, local banks and key national actors such as Ministries of Energy, Agriculture and Finance to appraise renewable biomass⁵ projects for PPAs and lending</p>			
2) Promoting investment in biomass-based electricity generation through appropriate catalytic financial incentives available for project investors	TA & INV	Increased investment in clean energy technologies and low-carbon practices in the agro-forestry waste sector	<p>2.1 Renewable Energy Guarantee Scheme (REGS) established and capitalized to support private investment in biomass plants</p> <p>2.2 MOU signed with a local development bank in Benin, after call of tender, to set out the objective, funding mechanism, administration rules and confirmation of their participation as fiduciary agent of the REGS</p> <p>2.3 Installed capacity of 4 MW generation biomass energy from IPPs (with off-take partially guaranteed from REGS)</p> <p>2.4 Signed Agreements between private investors and SBEE covering the obligations and rights of the partners regarding installation, operation and maintenance of all</p>	GEF	<p>1,200,000 (CCM)</p> <p>Total= \$1,200,000</p>	3,150,000

⁴ African Guarantee Fund and Economic Cooperation

⁵ Renewable Biomass means biomass issued from agricultural and forestry residues. This is in opposition nonrenewable biomass, issued from tree cutting and active deforestation

			<p>biomass plants supported under the project</p> <p>2.5 Standardized baseline developed for renewable energy based electricity generation, leading to reduced carbon finance transaction costs</p>			
3) Facilitation and establishment of the first biomass plant in Benin	INV	<p>A functioning business model is demonstrated for the technical and financial viability of biomass based plants</p> <p>Sustainable O&M&M models are demonstrated</p>	<p>3.1 Established partnerships between the public (power utility) and private (IPPs) stakeholders involved in the value chain of a biomass plant of 1 MW biomass electricity generation through gasifier technologies in the Kalalé site.</p> <p>3.2 Financial incentives, with off-take partially guaranteed from REGS, given to IPPs for the construction and commissioning of the biomass plant.</p> <p>3.3 Developed inclusive supply and value chains of feedstock (Established feedstock supply chain for biomass from agriculture and forestry residues)</p>		<p>\$500,000 (CCM)</p> <p>Total= \$500,000</p>	4,500,000
4) Land use and sustainable forestry management and implementation	TA & INV	<p>Pressures on natural resources from competing land uses and sustainable agriculture development in 9,000 ha are reduced through uptake of SLM and SFM practices leading to the following benefits:</p> <p>LD</p> <ul style="list-style-type: none"> - reduced soil erosion - increased soil fertility - increased agriculture harvests and residues <p>SFM</p> <ul style="list-style-type: none"> - Direct rehabilitation of 3,000 hectares of forest in Three 	<p>4.1 Institutional planning and interventions for sustainable agriculture management</p> <ul style="list-style-type: none"> - <i>Integrated agricultural land use plans in place</i> - <i>Definitions established in plans of threat hotspots, measures to address threats and legal provisions for management and protection</i> - <i>Conservation farming practices identified and piloted over 3,000 ha in Kalalé</i> - <i>Fire management practices operational over 3,000 ha in Kalalé</i> - <i>Site-specific forest rehabilitation done over 3,000 ha in the Three Rivers forest reserve</i> - <i>Proper livestock management, with best practices piloted in Kalalé</i> <p>4.2 Institutional Framework for local SLFM governance in the Department of Borgou</p> <ul style="list-style-type: none"> - <i>Build from the “integrated management plans for classified forests” conducted by other</i> 	GEF	<p>\$900,000 (LD)</p> <p>\$815,000 (SFM)</p> <p>Total= \$1,715,000</p>	4,000,000

		<i>Rivers forest and in critical riparian zones resulting in 45,000 t/CO2 of additional carbon stocks</i>	<i>ongoing GEF funded projects and ensure quality, deeper analysis and produce exactly what is needed for the Three Rivers forest management</i> <i>- A System for effective monitoring and enforcement of the SLFM plans in place for the Three Rivers forest, with clear delineation of roles and responsibilities among key local stakeholders</i> <i>- Communities, traditional authorities, and key local stakeholders collectively engaged and capacitated to implement SLFM to ensure forests rehabilitation and improve livelihoods</i> <i>- Best Practice guidelines for integrated agriculture, forestry and land management developed, disseminated and training conducted in the Department of Borgou</i>			
Subtotal						3,700,000 13,650,000
Project Management Cost (PMC) ⁶				GEF		172,602 650,000
Total Project Cost						3,872,602 14,300,000

C. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME IF AVAILABLE, (\$)

Sources of Cofinancing	Name of Cofinancier	Type of Cofinancing	Amount (\$)
National Government	Government of Benin	Cash and in-kind	5,000,000
National Government	District of Kalalé (through UNDF funding)	Cash and in-kind	3,000,000
GEF Agency	UNDP	Cash & in kind	300,000
Multilateral Aid Agency	Islamic Development Bank	Loan	3,000,000
Private sector	Private investors & banks	Cash & in kind	3,000,000
Total Co-financing			14,300,000

D. INDICATIVE TRUST FUND RESOURCES (\$) REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY¹

GEF Agency	Type of Trust Fund	Focal Area	Country Name/Global	Grant Amount (\$) (a)	Agency Fee (\$) (b) ²	Total (\$) c=a+b
UNDP	GEF TF	Climate Change*	Benin	1,959,132	186,117	2,145,249
UNDP	GEF TF	Land Degradation	Benin	1,000,228	95,022	1,095,250
UNDP	GEF TF	SFM	Benin	913,242	86,758	1,000,000
Total Grant Resources				3,872,602	367,897	4,240,499

¹ In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.

² Indicate fees related to this project.

*flexibility from the remaining STAR (+200,000 from BD)

E. PROJECT PREPARATION GRANT (PPG)⁷

⁶ To be calculated as percent of subtotal.

⁷ On an exceptional basis, PPG amount may differ upon detailed discussion and justification with the GEFSEC.

Please check on the appropriate box for PPG as needed for the project according to the GEF Project Grant:

- | | |
|-----------------------|----------------------------------|
| <u>Amount</u> | <u>Agency Fee</u> |
| <u>Requested (\$)</u> | <u>for PPG (\$) ⁸</u> |
| 100k | \$9,500 |
- (upto)\$150k for projects up to & including \$6 million

PPG AMOUNT REQUESTED BY AGENCY(IES), FOCAL AREA(S) AND COUNTRY(IES) FOR MFA AND/OR MTF PROJECT ONLY

Trust Fund	GEF Agency	Focal Area	Country Name/ Global	(in \$)		
				PPG (a)	Agency Fee (b)	Total c = a + b
GEF TF	UNDP	Climate Change	Benin	50,000	4,750	54,750
GEF TF	UNDP	Land Degradation	Benin	50,000	4,750	54,750
Total PPG Amount				100,000	9,500	109,500

PART II: PROJECT JUSTIFICATION⁹

PROJECT OVERVIEW - A.1. Project Description

Global environmental problems, root causes and barriers that need to be addressed

With an area of 114,763 km² and a population of slightly over 9 million inhabitants (2011), Benin is a small country in West Africa bordering the bight of Benin to the south, Togo to the west, Nigeria to the east and Burkina Faso and Niger to the north. Agriculture employs 70% of the active population and contributes 36% to GDP. However, very little of the country's agriculture is mechanized and irrigation is only slightly developed. The industrial sector as a whole remains under-developed, contributing only to about 15% of GDP (2005) mainly with textile and cement industries. GDP per capita which has been growing at an average of over 5% per year for the past five years was estimated as \$1,481 per person in 2011. 70% of the population live in rural areas while some 30% are in urban areas. Projections show that Benin will continue to be dependent on subsistence agriculture, cotton production, and small-scale regional trade.

Benin's climate reflects a strong north-south gradient, with an equatorial coastline transitioning northward and inland to an increasingly arid continental zone. More than half of the population is concentrated in the south, representing only one-tenth of the country's land (CBD 2002). The Niger River, one of the largest in Africa, forms a 120-kilometre-long border between northeast Benin and Niger.

Benin ratified the UNFCCC on 30 June 1994 and the Kyoto Protocol on February 2002. An initial national communications to the UNFCCC was submitted in 2002 and the second national communications (SNC) was submitted in 2011. The SNC highlighted that the agriculture/forestry sector is responsible for 68% of the GHG emissions, followed by the energy sector, accounting for 30%.

Status of the Energy Sector

Benin's total energy consumption was estimated at 2,256 kTOE in 2005, with an average of 0.305 TOE per capita. Biomass from wood (including charcoal) is still the main energy source, which contributed to 67% and 52.9% of Benin's energy mix in 2002 and 2009 respectively. Combined with the clearance of land for agriculture, this important dependence on biomass energy has led to a high pressure on forestry resources, still mainly considered as non-renewable despite various reforestation projects undertaken. It is estimated that Benin is losing

⁸ PPG fee percentage follows the percentage of the GEF Project Grant amount requested.

⁹ Part II should not be longer than 5 pages.

50,000 hectares of native forest cover each year. Between 2002 and 2009, the share of renewable electricity in the final energy mix barely increased, reaching around 5% today. On the other hand, the share of petroleum products rose from 31% to 38%, mainly due to an increase in domestic consumption of gas (increased availability on the market) and an increase in the automobile fleet.

The total electricity consumption was estimated at 702 GWh in 2007 with 25% of the population having access to electricity (but only 2% in rural areas) and a peak load of 120 MW. Benin imports 85% of its electricity from Côte d'Ivoire, Ghana and Nigeria through the bi-national power utility, the Community of Electricity in Benin (CEB), owned by the Governments of Benin and Togo, and supplying electricity to national distribution utilities in both countries. Since 2006, the CEB has been unable to supply the agreed amount of electricity to the national electricity utility, the Société Béninoise d'Énergie Electrique (SBEE), due to the energy crisis in the three supplying countries. In order to meet the domestic demand, the SBEE now operates costly thermal power plants, which consume annually about 120,000 tons of imported fuel oil. All petroleum products are imported. The only demand-side management measure applied by SBEE so far is unscheduled load shedding and power cuts.

The Community of Electricity in Benin (CEB - Communauté Electrique du Bénin) was founded in 1968 by a treaty between Benin and Togo. The headquarter is located in Lomé (Togo), with representative in Cotonou. Its overall mandate is to function as a cooperation agency, managing the generation and transmission of electricity in both countries. The Benin Electricity Power Corporation (SBEE - Société Béninoise d'Énergie Electrique) was founded in 2004, after the separation between the water and electricity management. Its overall mandate is to manage the importation, generation, transmission, distribution of electricity in Benin. It is placed under the supervision of the Ministry of Energy and has a para-estate status, which gives it some management autonomy and flexibility. However, for important issues such as pricing and major projects investments, SBEE should seek clearance from Ministry of Energy. There are some overlap between the two entities (CEB/SBEE) in the generation and transmission of electricity, but there are agreements and a production site or transmission segment is managed by one of the two, never the two at the same time. The same occurs on the ownership of production assets and transmission lines.

The grid in Benin is particular, as it has two parts: the northern grid and the southern grid. These grids are not inter-connected in Benin, but in Togo, through the wider bi-national grid. This means that if an electricity is generated in the North of Benin, to reach the South, it has to go through Togo, and vice versa. There are some localities that have not access to the grid, where SBEE is managing local thermal based mini-grids. The electricity in these mini-grids is generated at high cost (0.40 USD/kWh) and only for 6 hours per day. The electricity is heavily subsidized in Benin. The average tariff applied by SBEE to its consumers is 80 CFA/kWh (0.17 USD/kWh). This is subsidized by 30% to 50%, depending on the source of the purchased/produced electricity¹⁰.

The development of the energy sector will continue to focus on the main problem of extending grid access to the 75% of the population who do not have access to electricity. Domestic production of energy and domestic production of renewable energy sources will not receive priority. Over the next ten years, the grid in Benin will likely expand and more of the population will access electricity. However the low degree of penetration of renewables in the electricity sector will continue. The significant problem of grid outages that arises from the fact that most energy in Benin is imported will not be able to be mitigated by grid connected and solar PV back up power production.

The main problem facing Benin in the development of the renewable energy market will continue. Benin will continue to meet a high percentage of its electricity demand from imported energy (currently at 85%) and without a domestic national framework, policies, institutions, and human technical capacity in place the market for renewable energy is likely to grow only very slowly. While a few donor funded projects may take place there will be no private sector investment in renewable energy. The national target for rural electrification of 36% by 2015 and 65% by 2025 will struggle to be met and where progress is made it will be from expansions of the national grid rather than a focus on domestic energy production and in particular renewable energy production. Important

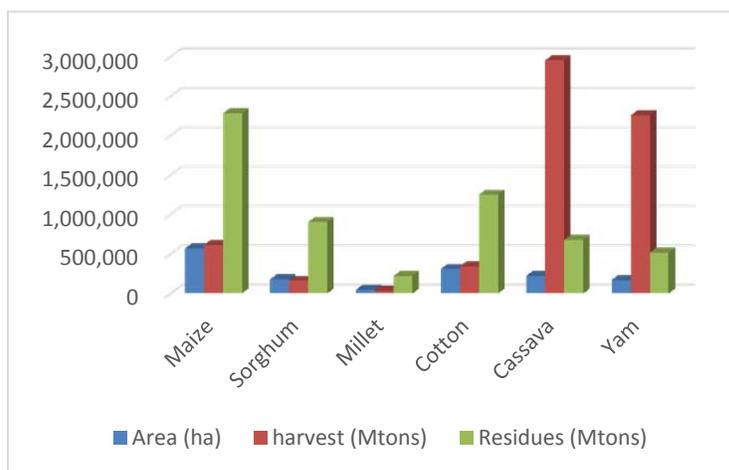
¹⁰ Source: On-Grid Rural Electrification in Benin, GIZ (2010)

renewable energy solutions such as mini and micro hydropower, biomass and biogas generated energy, and solar PV solutions will receive minimal attention and investment in these technologies is highly unlikely to eventuate. National policies and programs and policies for the rural population focused on grid expansion and generation of jobs in rural areas will not have any emphasis on renewable energy production. In summary, in the baseline situation, the future development of renewable energy in Benin for grid-connected solutions appears quite bleak for the simple fact that the Government has other priorities with the limited resources it has at its disposal.

The share of renewable energy in the energy balance in Benin is less than 5% consisting of fuel wood and charcoal, a small amount of hydropower and some small industrial units generating their own electricity from biomass residues such as cotton husks and palm husks. This is expected to increase in the future as new investments in hydroelectricity are realized. According to a recent study, 27 sites with a hydroelectric capacity potential higher than 2 MW were identified in the country. Total hydro capacity was estimated at 882 MW for an annual potential production of 2587 GWh, i.e., more than twice as much as the electricity imports in Benin in 2009. Mini, micro and small hydro systems appear also widely feasible across the country for rural electrification, in particular in the northwest for capacities lower than 1000 kW, in the center of the country for capacities between 1000 and 2000 kW and in the south for larger installations. Reported minimal sun irradiation of 3.5 to 5.0 kWh/m²/day provides Benin with an annual potential of 1800 to 2200 kWh/m²/day solar energy. Wind velocity fluctuates between 3 and 5 m/s at 10m altitudes but a detailed study is still missing to estimate with more accuracy the country’s potential for wind energy, which seems particularly promising along the Bight of Benin.

Benin has a huge potential of renewable biomass, especially from agriculture residues. It is estimated from national statistics¹¹, that biomass could potentially support the installation of more than 700 MW power generation capacity, using simple pyrolysis techniques such as gasification, from agriculture residues. 27% of agriculture residues can be realistically exploited, leading to the generation of 300 MW energy capacity, and saving 300 million USD per year from electricity and fossil fuel importation. Even though hydropower is the best proven technology, in the case of Benin, the hydro potential is in the South, while deforestation and land degradation is happening in the North. The North does not have enough hydro potential. So focusing on biomass electricity generation is the best option to work at the nexus of land degradation, forest management, agriculture and renewable energy in Benin. The figures bellow summarize the potential of agriculture residues, and their potential electricity generation.

Figure1: Annual crop production in Benin (2005)



¹¹ Source: Ministry of Energy (2005)



Figure2: Energy potential of agriculture residues in Benin (2005)

Agriculture clearance and charcoal production, main drivers of land degradation and deforestation

Land degradation and loss of natural habitat represents an escalating problem in Benin. Each year 50,000 hectares of forest cover is lost, primarily stemming from the charcoal industry and clearance for agriculture. Benin's semi-arid northern territories are vulnerable to desertification, with an estimated 50% of lands already affected. Although periodic drought is a natural driver of this trend, agriculture is the primary human cause due to its role in deforestation, soil erosion, and pollution. In particular, the relative profitability of cotton, which accounts for 80% of all export revenues in Benin¹², has resulted in increasingly intensive farming practices. In the north, cotton production is directly linked to widespread deforestation, chemical pollution by pesticides and fertilizers, and reduced soil fertility.

Agriculture remains the dominant domestic sector in Benin accounting for 45% of the country's GDP and employing 70% of the population. The sector is dominated by crop production, including maize, yam, cassava, rice, sorghum, cotton, palm oil, cashew and others. Waste agricultural residues produced from these sub-sectors represent a large and virtually untapped energy resource.

A dense tropical rain forest once covered much of Benin, but slash-and-burn agriculture and heavy dependence on fuelwood have driven rapid deforestation. Mangrove forests, on the other hand, are threatened mostly by fishing and salt production. Overall, Benin has lost nearly one-third of its forest cover since 1990, and the rate of forest loss between 2000 and 2005 was high at 2.4% per year¹³. Slash-and-burn agriculture is estimated to affect 160,000 hectares of forest per year.

As regards the specific physical interaction of land use change and impacts on agriculture, current trends in Benin reveal that forest clearance and unsustainable land use practices are causing soil erosion which in turn has led to reduced soil fertility. If left unattended these processes can be expected to have several broader impacts, such as major threats for food security; decrease of agriculture harvests; reduced agriculture residues (which is a threat to utilization of the country's biomass potential for electricity generation).

Specifically in the Kalalé district (department of Borgou, north-east of Benin), where the proposed GEF project intends to work, there is massive deforestation due to conversion for agricultural and charcoal production. The "Three Rivers forest" (la foret des trois rivières), located in 4 districts including Kalalé, is the largest forest in north-east Benin, with an area of 259,500 ha. It is a State Forest Reserve. Kalalé district covers an area of 3,586

¹² Source: Brottem (2005)

¹³ Source: FAO (2007)

km², representing 3.18% of the national territory of Benin. The three river forest reserve occupies a large part of the total area of the district. Animal species such as elephants and buffalos are present in the forest.

There are several forest classifications in Benin¹⁴: protected areas, forest reserves, sacred forests, and gallery forests. Regarding forest reserves, there are 44 inventoried throughout the country, totalling 1,292,543 ha, or 11.5 % of the national territory. All these forested reserves were gazetted by the colonial governments in the 1940s and 1950s, generally to protect the upper courses of the main watercourses or to preserve, as sanctuaries, natural samples of the fauna and other resources, or even to serve as sites for reforestation. There are three categories of forest reserves in the country:

- Forest reserves wherein hunting for fauna is forbidden, but where forest or mining exploitation can be done. These are the following forest reserves: *Trois Rivières (259,500 ha)*, Ouémé Supérieur (177,542 ha), Wari-Marou (107,500 ha), Goun-Goun (80,668 ha), Sota (53,000 ha), Wénou-Bénou (30,000 ha), Lama (16 250 ha), Tanéka (1,090 ha), Tchaourou (1,192 ha), Sérrou (498 ha), and Tchatchou (200 ha).

- Forest reserves in which not only forest and mining exploitation but also hunting is authorised using traditional means of hunting. These are the following forest reserves: Monts Kouffé (186,203 ha), Alibori Supérieur (256,000 ha), Atchéribé (3,150 ha), Bassila (2,500 ha), Bellefougou (1,300 ha), Birni (3,200 ha), Dan (1,237 ha), Dogo (31,850 ha), Guéné (1,300 ha), Kandi (250 ha), Collines de Kouandé (4,560 ha), Logozohè (1,200 ha), Savalou (1,159 ha), Agoua (63,182 ha), Atlantique (900 ha), Dassa –Zoumè (2,078 ha), Djigbé (3,594 ha), Agrimey (2,497 ha), Setto (1,013 ha), Mékrou (9,390 ha), N’Dali (4,721 ha), Ouèdo (586 ha), Pénéssoulou (5,470 ha), Toui (29,030 ha), and Bonou (645 ha).

- Forest reserves of especially small size created with the goal to essentially protect these particular sites. This group consists of the forest reserves of Boko (300 ha), Ichédé (191 ha), Natitingou dam (142 ha), Soubroukou (84 ha), Touzoun (66 ha), Sakété (60 ha), and Kilir (50 ha).

Over a long period, the three river forest, as most of forest reserves, have not benefited from development planning (compared to protected areas). The forest reserves have been “no-man’s-lands” where all the abuses of illegal exploitation of state lands have been observed. Today, the forest reserve in Kalalé is threatened by vegetation fires, agriculture, charcoal production and pollution.

In Kalalé, the existence of croplands, pasture, organization of farmers and ranchers is the basis of a variety of crops (yams, cotton, maize, sorghum, peanut, cassava, cowpea, and rice) and a large livestock (cattle, sheep, goats, swine, poultry). If the Forest Reserve of Three Rivers is an asset for the district, its protected character makes it a constraint for farmers willing to have more arable land and pasture. The lack or poor demarcation of the forest limit favour land conversion into agriculture field. Agro-pastoral activities contribute to deforestation, soil depletion and poor grazing management, which poses a problem of sustainability.

Today, the Three Rivers forest reserve is still quite large in terms of area, but not unfortunately in terms of flora and fauna.

Barriers

Barrier 1 - Absence of a clear market-oriented energy policy and legal/regulatory framework for biomass electricity generation: The lack of a clear enabling environment for biomass electricity generation prevents the country from fully exploiting its proven biomass resource potential via market investments. The problem in Benin is that the country lacks a solid national framework to promote renewable energy and there is a lack of human

¹⁴ Assogbadjo A.E. & Sinsin B.; State Forest reserves. In: Sinsin B. & Kampmann D., eds. Biodiversity Atlas of West Africa Volume 1 Benin (2011)

capacity to support the development of the renewable energy industry. Currently, there are many problems, which are preventing the development of a commercially viable renewable energy industry in Benin despite high potential. There are no specific policies in place to specifically promote renewable energy. There is no legal or regulatory framework enforced for renewable energy projects and no system of providing preferential tariffs or preferential grid access for renewable energy producers. There are some specific framework for big hydropower projects, which still not fully applicable, and too narrowed to this type of energy.

Under the Benin-Togo electricity code, there are actually two conditions to operate as an IPP in Benin: (i) Sign an agreement (concession) with the Government; (ii) Sign a PPA with either CEB or SBEE. This applies to all IPP regardless of the source of energy (renewable or not). The second condition constitutes a serious barrier, as it is highly recommended that a third party is included in the PPA.

One clear real-life example of this barrier is the situation with the Kalalé biomass gasification project, which has been initiated since 2008. That project aims to install a pilot decentralized electricity generation unit through gasification technics of agriculture residues, in Bouka (region of Kalalé, north of the country). The capacity of that pilot unit is 250 kW. However, the project is not yet materialized due to lack of adequate enabling environment and frameworks. Private IPPs did not want to be involved due to two main reasons: (i) the power purchase agreement (PPA) was not in their favor; (ii) the risk associated with investing in the plant was high, and private IPPs failed to secure funding from appropriate financial institutions.

This example underscores the types of policy barriers facing potential investors in the renewable energy (RE) sector. There is a general lack of institutional capacity across the Ministry of Energy, the power utility and other government agencies to develop the required policies. The country also lacks adequate environmental safeguards and climate-resilience measures for the biomass sector and does not have any methodology in place for joint environmental, economic and financial evaluation of renewable energy plants in line with existing government regulations and policies. Integrated energy and Natural Resource Management (NRM) planning are also hampered by unclear mandates and lack of coordination among government departments in the energy and NRM sectors.

Barrier 2 - Lack of appropriate financial de-risking incentives for project investors in the energy sector which can mitigate off-take risk for energy sales: Even if the appropriate enabling environment were in place for private investments in on-grid RE, there remains significant off-take risk in Benin related to any energy sales (on-grid) to the power utility (SBEE) by a private IPP. In the WB/IFC Doing Business 2014 data, Benin is 157 out of 189 economies on protecting investors and 181 out of 189 on enforcing contracts.¹⁵ There is in the country, a severe lack of equity and inability to secure financing for renewable energy based projects. The financial conditions of SBEE is not good. Its debts vis-à-vis CEB is estimated to be more than 10 million USD.

For off-grid / mini-grids, the upfront investment to shift from a diesel based to a RE or hybrid based mini grids is a barrier. Adequate de-risking incentives should be given to investors to facilitate their engagement in this type of grids, where the market size is critical to have a financially viable system.

Barrier 3 – Lack of technical capacity to handle renewable energy based plants: There is a lack of technical capacity related to the planning, development, financing and operation of renewable energy projects in both the public and private sector in Benin. In particular, domestic private sector capacity is very weak. Some Renewable Energy sources (wind, solar, biomass) are perceived as hard to manage because of the variability of the power production. In addition, some specific power generation sources, such as renewable biomass, will require qualified people to manage the system.

¹⁵ See <http://www.doingbusiness.org/data/exploreconomies/benin>

Barrier 4 – Lack of integrated approach for agriculture, land and forest management: Scientific publications, such as *Landcover evolution in Three Rivers forest reserve's surroundings (Benin), between 1949 & 1986*¹⁶, clearly demonstrates through aerial photographs, a massive deforestation and an important increase in anthropogenic pressure in the Three Rivers forest and its surround areas.

In summary, there are four major hurdles to the preservation and sustainable management of lands and ecosystems in the country: a) lack of technical capacity and know-how; b) insufficient planning and regulation; c) the absence of inter-sectoral institutional coordination frameworks; and a complex local governance context, with the existence of customary rights for land and forests uses and the role of traditional authorities.

Specifically for the Three Rivers forest reserve, located in Kalalé in the north-east of the country, there are several problems that prevent good management:

- *Insufficient planning and regulation:* for example, hunting is just forbidden, but forest exploitation is not and this led to mis-understandings and abuses.
- *Non enforcement of forest laws and forest governance:* for example, the forest is not properly delimited and this does not prevent intrusions
- *Extensive agriculture:* this is one of the main drivers of deforestation in the three river forest. Due to regular droughts, Arable lands are decreasing and farmers are converting the forest into crop production. The forest reserve has the advantage to have Three Rivers inside, and then sufficient water. At the mouth of the Three Rivers, the land is particularly fertile.
- *Livestock transhumance:* Kalalé has many pastoral activities. Due to lack of forest protection, stray animals is particularly important, for better pasture. Due to its proximity to Nigeria, Niger and Burkina Faso, international transhumance is also noticed.
- *Fuelwood and charcoal production:* due to lack of appropriate clean cooking fuels, massive fuelwood and charcoal are produced from the forest reserve.

Baseline scenario and associated baseline projects

The main relevant baseline activities are described below and summarized in Table 1.

Decentralized electricity generation through gasification technologies using agricultural residues: The project consist of a small unit to be installed in the north of the country, in Bouka, district of Kalalé. The pilot phase consist of construction a power generation plant of 400 kW installed capacity, using agricultural residues, mainly cotton redisudes, as feedstock. The feasibility study was conducted in 2008 and funded by UEMOA (the West Africa monetary union). The project is planned to start by 2015, and expected to be funded by the IDB (Islamic Development Bank). The long delay between the feasibility study and the implementation is due to the failure so far to secure funding, which in turn is due to lack of confidence from investors.

The GEF funded project will build on this baseline project, by (i) putting in place the enabling environment that de-risks the investments towards this type of business; (ii) move the pilot decentralized unit to a well-designed and effective biomass gasification based power plant; and (iii) increase the capacity from 400 KW to 1 MW, the increase resulting to secured investments towards biomass energy generations. The new project, with GEF support, could be either on-grid or off-grid, functioning as mini-grid. The PPG phase will assess the best option.

Production of solid biofuels and electricity generation from forest, agricultural and industrial residues (PABIOSE): The PABIOSE project is supported by the Ministries of energy and Sustainable development. It consists of promoting the use of alternative energy sources to wood energy and production of electricity from waste (agricultural, forestry and industrial) at districts levels in Benin. The project has 5 components: (i)

¹⁶ Toko Mouhamadou, I. & Ozer, A. (2007) Landcover evolution in Three Rivers forest reserve's surroundings (Benin), between 1949 & 1986

Production and promotion of alternative solid biofuels wood energy (briquettes, granular, pellets ...); (ii) Production of electricity from biomass plants (agricultural and forest residues and industrial); (iii) Development of the promotion of plantations, reforestation and land restoration; (iv) Development financial credit mechanisms for renewable development; and (v) Capacity building and project management.

Each component has its site of intervention. Component 2 will be specifically implemented where high agriculture/forestry residues are identified, in districts such as Kandi, Banikoara, Gogonou, Kérou, Kalalé, and Abomey-Bohicon. Kalalé will benefit also from components 3; 4 and 5.

The feasibility studies are undergoing. The implementation period is planned from 2015 to 2019. Its overall budget is 20 million USD but not yet secured.

The GEF funded project will also build on thus baseline project, by facilitation the implementation of component 2 (biomass plants), component 3 (sustainable forest and land management), component 4 (financial instruments) and component 5 (capacity building).

Government reforestation initiative “10 million souls, 10 million trees”: The Government of Benin launched in July 2013, that initiative, which is planned for 5 years, and supported by UNDP and World Bank. The overall objective of the project "10 million souls, 10 million trees" is to contribute to the improvement of people livelihoods in urban and rural cities, by planting and maintenance of plants in all municipalities to mitigate the adverse effects of climate change and the conservation of biological diversity. Specifically, it will (i) increase the area of forest cover; (ii) promote species adapted to the climate of each region and local needs; (iii) ensure the protection of sensitive sites and human settlements through reforestation; and (iv) raise awareness and build the capacity of schools and universities on environmental and civic education. Basically the initiative will enhance the sustainable land and forest management (SLFM) of the country. The overall budget of the programme is 40 million USD.

Municipal development plan of Kalalé (2011–2015): The United Nations Democracy Fund (UNDF) has supported the commune of Kalalé to draw a development plan for 5 years. The plan has 4 axis: (i) Social development (health, education, water); (ii) Economic development (agriculture, energy, transport, local economy, tourism, and mining); (iii) Governance (district services, financial resources, gender, security, decentralized cooperation); and (iv) Environment and territorial management (natural resources, land tenure).

The objective of the municipal development plant is that Kalalé district becomes by 2025, a modernized agro-pastoral, united, and well governed area where peace, health, education, sanitation, food security and sustainable management of the environment are guaranteed for men and women with a dynamic economy.

The overall budget of the municipal development plan is 7 million USD.

Local banks: The banking system in Benin is still in a development stage. There are lot of commercial and international banks present in the country. Local banks face several difficulties preventing them to invest in the energy sector, such as a clear legal framework and a guarantee scheme that would cover the high risks. However, some of them have credit lines for infrastructure projects that can be channeled to the energy sector for investment.

Table 1. Summary Overview of all Relevant Baseline Activities

Initiative	Budget
Government of Benin	5,000,000
District of Kalalé (through UNDF funding)	3,000,000
Islamic Development Bank	3,000,000
Private investors & banks	3,000,000
Total co-finance (sub-total excluding UNDP co-finance)	14,000,000

The proposed alternative scenario, with brief description of outcomes and components of the project

In an effort to address the listed barriers, this project aims to pioneer an integrated energy and ecosystems-based approach to grid-based biomass electricity generation in the country via four interrelated components: 1) development of an appropriate regulatory framework; 2) catalytic de-risking instruments for investors; 3) facilitation of the establishment of a biomass power plant; and 4) land use and sustainable forestry management and implementation. Such an approach will help to deliver multiple global environmental benefits in synergy in key sectors of the economy. This will lead to the direct reduction in GHG emissions from the electricity generation and land use sectors and ensure that all new biomass plants that come online are sufficiently climate-proofed, as well as alleviate land degradation and promote sustainable agro-forestry in the country.

As regards the energy-related components, it is important to note from the onset that this project's design is illustrative of and modeled on the approach presented in recent UNDP and GEF publications ('Transforming Renewable On-Grid Energy Markets' and 'De-Risking Renewable Energy Investment') in that it proposes a combination of policy de-risking instruments and market-enabling activities under Component #1 that will then be followed by the introduction of a financial de-risking instrument (in this case a partial guarantee fund) under Component #2, and a showcase under Component #3.

The four different components of the project are briefly described below:

Component 1: Policy, institutional, legal and regulatory framework for biomass energy generation established

This component seeks to remove the underlying barriers that have prevented a market transformation of the sub-sector by developing a streamlined and comprehensive market-oriented energy policy and legal/regulatory framework for biomass electricity generation by Independent Power Producers (IPPs). Among the relevant activities for funding are the core prerequisites for investments (technical report on grid capacity requirements, establishing a transparent procurement mechanism for selection of IPPs and off-take arrangements, standardization of PPAs, etc.). The project will also fund a national standardized baseline for renewable energy based electricity generation which is a key "public good" for private investors to develop carbon finance projects that add a secondary revenue stream to the development of biomass plants in the country.

The project's integrated energy and ecosystems-based approach consists of a number of activities to ensure coherence of the legal/regulatory framework for on-grid and off-grid biomass plants. This includes adoption of a methodology for a joint environmental, economic and financial evaluation of all biomass plants in line with government regulations and policies. Specific assessments will be done for all biomass applications made under the new procurement mechanism to ensure adequate bank protection in the relevant agricultural zones to minimize soil erosion and prevent loss of fertility.

This component will also develop a *Framework for re-investment of energy proceeds into community conservation*. This will establish a mechanism integrated into the legal energy frameworks formulated under Component #1 requiring that IPPs whom rely on and benefit from high biomass potential site restoration or preservation are mandated to contribute to either a centralized fund or community trust which then channels those funds back into community-level interventions. The exact structure of the benefit sharing schemes will be designed during the PPG phase and first year of the project as part of the development of the policy framework and standardized PPAs under Component #1. In addition, the project will create income generating opportunities by having local farmer commercialize the residues and sell them to the plant or to some company created to ensure the feedstock supply. This will generate buy-in from local communities.

The Ministry of Energy, Mines, Water and Renewable Energies, in coordination with other key stakeholders such as SBEE and Ministries of Environment, Agriculture and Forestry, will be responsible for the energy-related

policy work and will work in close cooperation with the Directorate-General for Environment (the agency responsible for environmental policy) on the land use measures mentioned.

Component 2: Promoting investment in biomass energy generation through appropriate catalytic financial incentives available for project investors

Under this component a RFP for installed capacity of 4 MW of both on-grid and off-grid (mini-grid) generation from biomass IPPs will be launched following the completion of activities under Component #1. On on-grid, the private sector is expected to play a key role in project implementation since at present SBEE requires government support in order to remain financially viable and the country does not have cost-reflective tariffs; as such it seems that private investment is the best short-term option to bring on additional generating capacity. While various procurement options will be analyzed during the PPG phase, the likely scenario is a tendering option whereby IPP developers will be invited to apply to bid for biomass contracts of between 250 to 1,000 kW per installation. The premise in this approach is that SBEE's internal generation costs from Diesel GenSets is currently considerably higher than what an IPP developer would offer as regards energy off-take (on an LCOE basis) from a biomass plant and thus there is a strong incentive for SBEE to sign PPAs with IPPs. While PPP options will be explored and analyzed, the likely scenario is that the applicants to the RFP will need to arrange their own debt and equity from private sources.

Preliminary analysis has suggested that in the short-term the most effective way to mitigate such significant investor off-take risk already mentioned would be through the establishment and capitalization of a Renewable Energy Guarantee Scheme (REGS). This would be a type of partial risk guarantee that would cover IPPs against the risk of a public entity (in this case SBEE) not fulfilling its obligations with respect to the off-take agreements in the PPAs developed under Component #1. The REGS would be a non-grant financial mechanism established at a national development bank or the Central Bank (BCEAO), or a public international organization, specialized in guarantee scheme managements such as FAGACE (African Guarantee Fund and Economic Cooperation); and linked to the RFP for project developers to submit bids for investing in biomass systems for feeding into the grid with the REGS securing the risk on the off-take. The REGS would be designed during the PPG phase but is envisioned as a partial guarantee scheme that would go into effect in the case of non-payment of the off-take from SBEE; the REGS would then step in and pay the developer a certain percentage of foregone income (in cents/kWh e.g.) based on the non-performance of contractual obligations under the PPA. This would indirectly reduce the overall risk profile for the investment, making it easier and cheaper for the developer to raise the necessary financing for the installation costs. If a REGS on the off-take was not feasible for whatever reason (this will be analyzed during the PPG) then it could be applied to the installation costs and partially cover the outstanding principal and accrued interest of an investor's debt tranche. Payment in that case would be made only to a given IPP if the debt service default was proven caused by risks specified under the guarantee and non-performance of contractual obligations undertaken by SBEE as part of the RFP and/or PPA.

The REGS can also be used for off-grid/mini-grids options, to reduce the risks between private developers and local banks associated to up-front investment.

It is estimated that by establishing the REGS and linking it to the policy environment reforms and frameworks developed under Component #1 the project could catalyze the commissioning of biomass systems of at least 4MW by private companies¹⁷, resulting in an estimated 17,520 MWh per year of clean electricity generated from biomass plants on the grid by end of project. Specific activities will be implemented to ensure systematic monitoring of GHG emission reduction from the biomass plants throughout their operations. The cost of the REGS and how much of the risk it would cover as regards either non-payment of energy delivered or debt obligations for the capital cost of a portfolio of biomass plants will be analyzed during the PPG phase. The cost of biomass obviously varies within countries and type of biomass burning technologies. According to IRENA¹⁸, biomass gasifier technology capital costs typically range from USD 5,570 to 6,545/kW. However, the Kalalé

¹⁷ This could include the already designed Kalale biomass gasifier plant

¹⁸ Renewable Energy Technologies: Cost Analysis Series / Volume 1/5 Biomass for power generation, IRENA (2012)

Biomass power plant feasibility study comparative financial analysis has shown that in Benin the cost of biomass based power plant is USD 3,500 – 4,000 per kW of installed capacity. At present we have estimated that with GEF capitalizing the REGS with an initial investment of \$1 million (50% of the CCM resources for Component #2) with a partial guarantee of some form (either on the off-take or capital costs) the guarantee could cover up to 4 MW of new installed capacity. What makes establishing the REGS attractive is that, if successful, it could easily be co-capitalized by other donor entities or the government as a performance-based mechanism. The exact REGS structure will be designed during the PPG phase. As well, the PPG phase will help determine the best location of the REGS: in a local development/commercial bank after a call of tender, in FAGACE (Benin office), or in the Central Bank BCEAO (Benin office).

Component 3: Facilitation and Establishment of the first biomass plant in Benin

The expected outcome from this component is the improved confidence of communities, developers, the power utility, IPPs and potential investors in the technical and economic viability of biomass power plants. This Component is directly interlinked with the establishment of the de-risking instruments under Component #2 and follows on the initiative to build a biomass power plant in Kalalé, based on gasifier technologies. It will be the first fully operational biomass plant in Benin. PPG phase will help to better determine is the plant will be connected to the grid, or functioning as a mini-grid in Kalalé.

Activities consist first to update the already conducted feasibility studies and environment impact assessments, to take into account an increased capacity of 1 MW for biomass-based electricity generation through gasifier technologies. These activities to update the feasibility studies and environment impact assessments will be fully funded by the Government, to update its call of tender for a 1 MW biomass plant. PPPs will be established between SBEE, IPPs and all other key stakeholders (farmers for example) involved in the value chain of the biomass plant. Financial incentives developed under previous Components will be utilized to help for the construction and commissioning of the plant. In order to ensure sufficient feedstock for the plant, an inclusive supply chain of agriculture and forestry residues will be developed.

Through the implementation of the pilot investment project, the appropriateness of proposed policy and financing instruments will be demonstrated. The demonstrations will also be used as a testing ground for developing a domestic technology supply chain. Furthermore, these demos/pilots are expected to generate valuable information on the suitability of, and the practical implementation of the operation & maintenance & management (O&M&M) models that will be developed.

Component 4: Land use and sustainable forestry management and implementation

This component has two broad categories of interventions. The first is *Institutional planning and interventions for sustainable agriculture management*. Under this component robust land use management plans will be developed enabling a sustainable agriculture practices, to support sustainable economic development, food security and environmental protection. The institutional planning will result in an integrated agricultural land use plan. It will also define hotspots where threats are concentrated, measures to address those threats and legal provision for proper management and protection. This will result in conservation farming practices and piloted over 9,000 ha in the three river forest reserve, in Kalalé, where the first biomass plant will be established. Best fire management practices will also be defined to substitute the artisanal slash-and-burn methods for agriculture clearing. Proper livestock management will be conducted, with best practices piloted in Kalalé, where transhumance and pastoralism is common.

Assessments will be done during the PPG phase as regards the most optimal conservation farming and fire management techniques and measures to be introduced in line with crop choices, soil types and local capacity.

Under the forest management plans and in tandem with the above-mentioned interventions, specific reforestation activities will be implemented in 3,000 ha in the Three Rivers forest. These on-site reforestation schemes will be in line with national directives, and will favor rapid-growth native species adapted to the region. These

rehabilitation activities will complement and reinforce more site-specific mitigation efforts that IPPs will be required to undertake as a result of the significant loss of the vegetation due to earthworks, truck movement and other construction activities related to the building of the plants.

The second sub-component is an *Institutional Framework for SLFM governance*. Under this category, the project will build from “integrated management plans for classified forests” conducted by other ongoing GEF funded projects and ensure quality, deeper analysis and produce exactly what is needed for the Three Rivers forest management. A System for effective monitoring and enforcement of the SLFM plans will be put in place for the Three Rivers forest, with clear delineation of roles and responsibilities among key local stakeholders. As well, Communities, traditional authorities, and key local stakeholders will be collectively engaged and capacitated to implement SLFM to ensure forests rehabilitation and improve livelihoods. Best Practice guidelines for integrated agriculture, forestry and land management developed, will be disseminated and training conducted in the Department of Borgou.

The PPG phase will help define the adequate and appropriate local governance for the Borgou Department, with clear role and responsibilities of local stakeholders (traditional authorities, farmer organizations, communes, etc.).

The project will also ensure that the biomass use as feedstock for energy production will not have negative impact on the biomass market and associated natural resources beyond its completion. Especially, the project will ensure that the maximum amount of energy is extracted from the same material input (efficient energy use of biomass), while avoiding any negative environmental effects potentially associated with its production. This will help favor the use existing resources efficiently before looking for additional demands on biomass for energy production.

A full elaboration of all detailed linkages (and sequencing) between the various components will be done at PPG phase and provided at CEO endorsement.

Incremental cost reasoning and expected contributions from the baseline, the GEF TF and co-financing

The GEF funds will be used for incremental activities designed to remove the identified barriers. In particular, the GEF funds will be used for those incremental activities that expand the scope of, or supplement, the baseline activities in leading to or enhancing global environmental benefits. A component-by-component assessment of the incremental activities and expected GEBs is described below:

Table 2: Project Activities and Incremental Reasoning

Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 1: Policy, institutional, legal and regulatory framework for biomass energy generation established		
<ul style="list-style-type: none"> - A resource map of the country’s renewable energy potential has been conducted but, heavily focused on hydro and solar. And there is no clear market-oriented energy policy and legal/regulatory framework for biomass generation from IPPs - No standardized PPAs, grid capacity requirements or updated grid code - Investors have no access to a one-stop shop for licenses and approvals thus making transaction costs for development of biomass plants - Policymakers have no environmental methodology, safeguards and climate-friendly guidelines for biomass plants that minimize negative impacts to the 	<p>A market-oriented policy, institutional, legal and regulatory framework for climate-friendly, biomass gasifier power generation will be developed and codified to address all BAU barriers cited and in the short-term facilitate 4 MW of biomass capacity installed by private developers leading to 17,520 MWh of electricity generated per year</p> <p>Activities under this component will also develop a Framework for re-investment of energy proceeds into community conservation. The project will create income generating opportunities by having local farmer commercialize the residues and sell them to the plant or to</p>	<p>The electricity supplied to the grid by the plants facilitated by the project will result in a reduction of 248,740 tCO₂ over their lifetime</p> <p>The establishment of this framework will also apply to all future biomass based power generation investments and thus can be estimated to indirectly contribute to additional emission reductions post-project (this will be defined at the PPG phase)</p>

<p>country's vulnerable forestry resources</p> <ul style="list-style-type: none"> - SBEE, local banks and key national actors such as Ministries of Energy and Finance do not have the capacity to appraise biomass projects for PPAs and lending - No standardized baseline exists for renewable energy investments 	<p>some company created to ensure the feedstock supply.</p> <p>All activities under this component will be implemented to expressly address the broader issue of unclear mandates and lack of coordination among government departments in the energy and NRM sectors that is also a baseline practice under Component #4</p>	
Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 2: Promoting investment in biomass energy generation through appropriate catalytic financial incentives available for project investors		
<ul style="list-style-type: none"> - Overall Benin has a poor track record of enforcing contracts and protecting investors (see WB/IFC Ease of Doing Business rankings) <p>SBEE's precarious fiscal situation and dependence on a government that is at high risk of debt distress makes investors wary of possible contract default on PPAs and makes attracting finance for plants more difficult</p> <ul style="list-style-type: none"> - IPPs are left to their own devices to negotiate financing for possible energy investments with little security over whether PPAs will be finalized or contracts honored. - No de-risking instruments exists in the country to mitigate the off-take risk IPPs will face in deciding whether to invest in a renewable energy plant and the associated financial costs that come with that risk 	<p>The project will design a Renewable Energy Guarantee Scheme (REGS) that will be capitalized to support private investment in all the plants targeted for development under the project. An MOU will be signed with a qualified financial institution to set out the objective, funding mechanism, administration rules and confirmation of their participation as fiduciary agent of the REGS. The guarantee scheme will indirectly reduce the overall risk profile for the investment, making it easier and cheaper for the developer to raise the necessary financing for the installation costs of the plants. The combination of the policy framework supported under Component #1, the de-risking instrument – together with previous work mapping the resource base – will ensure that both policy-level and financial barriers are removed and the targeted IPP investments can be realized.</p>	<p>The electricity supplied to the grid by the plants facilitated by the project will result in a reduction of 248,740 tCO₂ over their lifetime</p> <p>The establishment of the REGS will also benefit future biomass based power generation investments and thus can be estimated to indirectly contribute to additional emission reductions post-project (this will be defined at the PPG phase)</p>
Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 3: Facilitation and Establishment of the first biomass plant in Benin		
<ul style="list-style-type: none"> - The country has no biomass plant effectively running and feeding the grid - There is an insufficient knowledge at country level on how to manage biomass based plants - there is no sufficient experience on O&M&M related to gasifier electricity generation technologies - Thermal and coal based plants continue to be built, with more than 700 MW planned constructions for the next years 	<p>This component will help to improve confidence of communities, developers, the power utility, IPPs and potential investors in the technical and economic viability of biomass power plants.</p> <p>Activities under this component will lead to the establishment of the first biomass power plant functioning in the country, with a 1 MW capacity.</p> <p>The established pilot plant will generate valuable information on the suitability of, and the practical implementation of the operation & maintenance & management (O&M&M) models that will be developed</p>	<p>The electricity supplied to the grid by the plants facilitated by the project will result in a reduction of 248,740 tCO₂ over their lifetime</p>

Baseline practices	Alternative to be put in place by the project	Expected Global Benefits
Component 4: Land use and sustainable forestry management and implementation		
<p>Degradation of ecosystems:</p> <ul style="list-style-type: none"> - Indiscriminate and illegal clear cutting of trees, including the deforestation of areas with declining tree populations. - Little crop rotation or fallow periods and/or intercropping with leguminous plants (intensive farming practices for cotton production) - Little transformation of agriculture residues into valuable products - Uncontrolled practice of human-caused fires of small woodlands and plowing fields done by farmers to clear land. - Excessive use of chemical fertilizers in traditional farming practices further contributes to the impoverishment of the country's arable lands - No on-site preservation activities and reforestation schemes in development zones - Livestock transhumance and pastoralism <p>Inadequate institutional management and capacity for forest protection</p> <ul style="list-style-type: none"> - No national legal framework for SLFM - Lack of appropriate land-use plans and tools to manage and develop renewable biomass investment potential. - No harmonized and coordinated inter-sectoral mechanisms across sectors that allow for integrated and coordinated approaches to energy and land use planning - No guidelines for mainstreaming SLFM into other sectoral plans - No mechanism for community-based benefits sharing from biomass plant installations 	<p>Two sub-categories of activities will be put in place by the project to address the BAU practices cited. The activities will include a mix of upstream institutional planning and governance support for the management of agriculture practices and SLFM sectors as well as a suite of specific downstream activities designed to address the core landscape-level drivers of degradation in the country. These will include promotion of conservation farming and fire management activities across 9,000 ha with a focus on critical threat hotspots.</p> <p>Specific reforestation activities will be implemented in 3,000 ha in the Three Rivers forest reserve near the proposed biomass plant site. These rehabilitation activities will complement and reinforce more site-specific mitigation efforts that IPPs will be required to undertake.</p> <p>The project will also the project will build from “integrated management plans for classified forests” conducted by other ongoing GEF funded projects and ensure quality, deeper analysis and produce exactly what is needed for the Three Rivers forest management. A System for effective monitoring and enforcement of the SLFM plans will be put in place for the Three Rivers forest, with clear delineation of roles and responsibilities among key local stakeholders. As well, Communities, traditional authorities, and key local stakeholders will be collectively engaged and capacitated to implement SLFM to ensure forests rehabilitation and improve livelihoods. Best Practice guidelines for integrated agriculture, forestry and land management developed, will be disseminated and training conducted in the Department of Borgou</p>	<p>The expected GEBs are multiple:</p> <p>LD</p> <ul style="list-style-type: none"> - reduced soil erosion - increased soil fertility - increased agriculture harvests and residues <p>SFM</p> <ul style="list-style-type: none"> - Direct rehabilitation of 3,000 hectares in the Three Rivers forest reserve near the planned biomass plant sites resulting in 45,000 t/CO₂ of additional carbon stocks

Global Environmental Benefits

A very preliminary and conservative estimate indicates that the total direct project CO₂ emissions reduction from the deployment of an additional 4 MW of installed capacity from biomass plants facilitated by this project is 248,740 tons¹⁹ which translates into an abatement ratio of \$7.14 of GEF CCM funds per tCO₂ reduced.

¹⁹ CO₂ emission reductions attributed to a combined total of 4 MW biomass plants:

As regards forest rehabilitation activities under Component #4, Benin does not yet have detailed carbon stock measurements but based on recent researches²⁰, the carbon stock in Benin forest is estimated to 30 t/CO₂ per ha. Based on this estimation, and with a target of rehabilitating 3,000 hectares in the Three Rivers forest via this project, and taking into account that the rehabilitated areas already contains some plantations, the resulting estimated additional carbon stocks would be 45,000 tons (very conservative).

Innovativeness, sustainability and potential for scaling up

The broader aim of this project is to pioneer a new paradigm for sustainable development of renewable energy plants in ecologically-vulnerable landscapes situations. Innovation is a central aim of the project with the focus on combining and sequencing instruments and approaches funded under different focal areas in a synergistic way and maximize GEBs. The focus of the RE component will be economically viable and proven biomass power generation based on gasifier technologies that have short gestation periods, low investment needs and minimal environmental impact. Certain components such as the REGS have tremendous potential for scale-up since once established and proven it's a ready-made performance-based financial mechanism that can be capitalized by further donor or government investments and either used to catalyze additional roll-out of biomass plants or even replicated for other RE technologies. The approaches piloted in this project can also be applied to all biomass electricity generation project and it is hoped that if successful this type of integrated and climate-friendly approach will be a model for similar development of RETs in Benin, Togo and other neighboring countries.

On the SLFM, Benin has 44 inventoried forest reserves throughout the country, totalling 1,292,543 ha. The Three Rivers forest reserve (259,500 ha) is only one of those. Rehabilitation actions in the Three Rivers forest will be replicated in the 43 remaining forest reserves.

A.2. Stakeholders. Identify key stakeholders (including civil society organizations, indigenous people, gender groups, and others as relevant) and describe how they will be engaged in project preparation:

The following table lists the stakeholders of the proposed GEF project. Included in the list are the summary of expected roles of each stakeholder in the design, development, implementation and management of the proposed project.

Stakeholders	Expected role
Ministry of Energy, Mines, Water and Renewable Energies	<ul style="list-style-type: none"> • Coordination of the overall project; and all aspects regarding policy design and implementation • Legislates and supervises the relevant directorates and SBEE
Ministry of Environment	<ul style="list-style-type: none"> • Participate in the coordination of the overall project; and ensure that proposed activities are in line with GEF GEBs criteria
Ministries of Agriculture and Forestry	<ul style="list-style-type: none"> • Ensure cooperation, coordination and integrated synergies
CEB/SBEE	<ul style="list-style-type: none"> • Facilitate the design of projects for PPAs and other related instruments
Ministry of Finance	<ul style="list-style-type: none"> • Lead and provide guidance on the conception phase of the financial mechanisms and incentives • Assist in the establishment and operationalization of financial mechanisms and incentives

Assumptions: (1) Capacity of biomass plants: 4 MW; (2) biomass power generation load factor = 50%; (3) Useful life of biomass plant = 20 years; (4) Benin grid emission factor = 0.7099 ton CO₂/ MWh

Calculations:

Annual Electricity Generation = 4_{Mw} * 8760_{hours} * 0.5 = 17,520 MWh

Annual CO₂ emission reduction = 0.7099 x 17,520 = **12,437 tons/year**

Lifetime CO₂ emission reduction = 12,437 x 20 = **248,740 tons**

²⁰ Saatchi S. and al; New carbon stock estimates for global tropical forests (2011)

	<ul style="list-style-type: none"> • Participate in the design of the REGS
Universities of Parakou and Abomey-Calavi	<ul style="list-style-type: none"> • Share significant scientific researches related to the Three Rivers Forests and other aspects of the Borgou region
FAGACE, BCEAO and Local Banks	<ul style="list-style-type: none"> • Participate in the design of the REGS
Private sector	<ul style="list-style-type: none"> • Ensure initiative sustainability • Participate in the high potential site selections • Provide O&M&M models
Farmers and local organization and NGOs	<ul style="list-style-type: none"> • Participate in the design of the feedstock value chain, the forest and land management • Organization and conduct of awareness raising campaigns • Knowledge sharing
Traditional authorities	<ul style="list-style-type: none"> • Participate in the design of the local governance model
Kalalé Commune	<ul style="list-style-type: none"> • Coordination of the overall project at local level, and all aspects regarding local governance and monitoring/evaluation
Multilateral donors: IDB, WB, AfDB, GIZ, etc.	<ul style="list-style-type: none"> • Commitments for support and share of experience
UNDP	<ul style="list-style-type: none"> • Provision of technical support to the project • Provision of M&E to the project

A.3 Risk. Indicate risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the project design (table format acceptable):

The following risks are identified but hopefully will be addressed and minimized through appropriate mitigation measures.

Risk	Level of Risk	Mitigation Action
The success of this project will be determined to a large degree by adoption and effective enforcement of the proposed policies. Lack of political support may jeopardize the achievement of immediate results and over-all impact.	Low	Initial consultations with the Government of Benin have indicated an interest and a willingness to definitely promote renewable energy based plants. The political will to support this project is strong.
Widespread ignorance or avoidance from banks and other financial institutions may lead to lack of ability to finance biomass power generation projects	Moderate	The project intends to build the capacity of local banks in line of RE investments. The project will also develop a REGS that will reduce significantly the risk.
Technology risks related to the introduced technologies, in particular the biomass technologies and their operation. Although the project will be establishing proven technologies, there might still be risks involved with the components	Moderate	The project intends to utilize proven feasible and affordable technologies and duplicate solutions that have been successfully introduced in several countries in the region. The project will establish technology transfer schemes from successful examples in African countries (Example: Biokala biomass electricity generation in Cote d'Ivoire).
The Three Rivers forest is located across 4 districts, Kalalé being only 1 of the 4. Even though if best practices are implemented in the Kalalé portion, unsustainable practices from other districts may jeopardize the effort of forest conservation/rehabilitation	Medium	Regarding forest conservation/rehabilitation, the project will consider the Three Rivers Forest as a whole, and not only work in the Kalalé portion. Farmers and populations in neighboring districts will also benefit from capacity building, share of best practices and ability to produce/sell feedstock to the plant located in Kalalé.

Risk	Level of Risk	Mitigation Action
Climate change is predicted to cause changes and increase variability of Benin rain patterns. If severe droughts occur due to climate change, farming activities will be badly affected and would decrease the availability of feedstock for biomass plants	High	If such situation occurs, the project will ensure that farming activities will continue to meet food security by introducing appropriate techniques for water management, such as dropwise and drilling.
Overall Risk Level	Moderate	

A.4. Coordination: Outline the coordination with other relevant GEF financed and other initiatives:

During the PPG phase, in-depth consultations will be undertaken to establish partnerships and practical modalities for linking and collaborating with all relevant ongoing and planned projects/programs in Benin. Initial discussions were conducted with the implementers/owners of the identified relevant projects that are ongoing and planned in the country, particularly those that will be used as baseline for the proposed GEF project. A strategy and plan for collaboration with relevant ongoing and planned initiatives will be prepared during the preparatory phase. It will include the delineation of the roles and responsibilities of the project implementers and owners, the scheduling of the baseline activities, the arrangements for the monitoring and reporting of results of the baseline activities that they will implement, and the joint evaluation of the results and outcomes of the baseline and incremental activities. The CEO endorsement request document will include a detailed description of the coordination mechanism.

The project will closely work with:

- A recently approved GEF LDCF funded project in Benin “*Strengthening the resilience of the energy sector in Benin to the impacts of climate change*”. It will complement the present proposed project, especially in the resilience of climate change impacts in the energy sector, for both on-grid and off-grid. During the PPG phase of the two projects, the implementation phase will be assessed to see whether it will be possible to have a unique project management unit for both project, and then reduce PMC.
- The project will also benefit from already on-going GEF funded projects, such as UNDP/GEF “*Incorporation of Sacred Forests into the Protected Areas System of Benin*”. Especially the project will benefit from local governance and cooperation with traditional authorities. The biodiversity project has implemented sustainable use models around sacred forests.
- A GEF/WB “*Benin Forests and Adjacent Lands Management*”. Especially, the proposed project will build from management plans for classified forests conducted by the GEF/WB and tailor it to the Three Rivers context. The project will also benefit from capacity building of institutions working in the forestry sector.
- The project will also liaise with the SGP program, which has developed several projects in the field of biomass supply chain, in the Three Rivers forest area, as well as strengthen a quite number of NGOs and CSOs.
- The proposed project is also one of a series of similar UNDP-GEF initiatives aimed at promoting an integrated energy and ecosystem based approach in Africa (such as *Promotion of environmentally sustainable and climate-resilient grid-based hydroelectric electricity through an integrated approach in Sao Tome and Principe*). These projects share the same market transformation approach and model for RE-based on-grid power generation. The portfolio will be coordinated by UNDP-GEF Regional

Coordination in Africa, including analysis and presentation of lessons learnt, organization of regular face-to-face and virtual networking, knowledge sharing and outreach activities and events.

The project will close work with the Universities of Parakou and Abomey-Calavi, which have developed numerous researchers related to the Three Rivers forest.

Few years back in 2007, an American NGO, the Solar Electric Light Fund (SELF), launched a project in Kalalé, to electrify all 44 agricultural villages in the district with solar power for mainly lighting and water pumping. Even though the project was implemented correctly, farmers and local community organizations established during the implementation, as well other outcome of that project, will likely be used.

B. Description of the consistency of the project with:

B.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NCSAs, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.:

The project is consistent with the **Second National Communications of Benin to the UNFCCC (2011)**. In its second national communications, Benin recognizes the importance of renewable energy both in reducing greenhouse gas emissions and in promoting sustainable development. The SNC highlighted that the agriculture/forestry sector is responsible for 68% of the GHG emissions, followed by the energy sector, accounting for 30%. The Greenhouse Gas emission from the Energy Sector increased from 1089 ktCO₂eq/year in 1995 to 1880 ktCO₂eq/year in 2010. While the national GES emissions are dominated by agriculture, the steady growth of energy demand will heavily increase the weight of the energy sector in the coming decades. In the Energy sector, to mitigation the use of fossil fuels in the electricity sector, one of the main mitigation measures are the increase of renewable energies in the energy mix. The SCN recommends by 2030, the installation hydropower plants (147 MW), biomass plants (30 MW), solar plants (25 MW), and wind plants (10MW). This shows, beside the high hydro potential in the South, the biomass potential is high in the country, especially in the North, where the proposed project is located.

This project is also consistent with the **National Strategy for Implementing the UNFCCC (2003)** for Benin, which defines renewable energy as an important priority for reducing GHG emissions and promoting sustainable development.

This project is also consistent with the **National Energy Policy of Benin (2008)** which proposes four main objectives for increasing domestic energy supply including to (i) increase the national capacities for power production, transport & distribution (ii) promote rural electrification, demand-side management & agro fuels projects in the energy mix, (iii) revise the electricity tariff scheme & introduce financing mechanism for the power sector and (iv) Strengthen institutional & regulatory capacities

The project is also consistent with the **National Development Plan for the Energy Sector (2009)** of Benin, which calls for calls for the use of untapped biomass potential for electricity generation. The Development Plan clearly favor biomass, compared to Solar or Wind, due to the abundant agriculture and forestry residues.

Benin is in the process of identifying and elaborating **Nationally Appropriate Mitigation Actions (NAMAs)**. Part of this work includes the importance of introducing low carbon technology in the power sector, through the promotion of all renewable energy resources locally available, both for on grid and off grid application in rural areas. This project is consistent with the NAMA elaboration work currently being undertaken in Benin.

This project is also consistent with the **National Adaptation Programme of Action (NAPA)** for Benin, which has identified climate change impacts and analyzed vulnerabilities to climate change and proposed courses of action to adapt to climate change, which includes greater use of renewable energy.

The project is also consistent with the objectives and priorities of the **Strategy and the National Report on Desertification and Land Degradation** (2004). The third national communication to the UNCCD recommends Several actions, among them: (i) the harmonization of the Nation Programme on Environment Management; (ii) the establishment of an appropriate database on environment and in particular on desertification and land degradation; (iii) and the implementation of measures that slower desert overhang aim at providing the inhabitants with improved living conditions.

B.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities:

This project has been designed with the express intention of responding to GEF's overall strategic vision under GEF V of helping countries meet their sustainable development needs and achieve multiple environmental benefits through an integrated approach. The project is consistent with GEF-3 CCM and LD strategies of assisting countries in the deployment and diffusion of low-carbon, renewable energy technologies through investment, capacity building, and technology cooperation and addressing management of competing land uses and resulting changes in land-ecosystem dynamics. The project will promote an integrated approach towards fostering sustainable land management that balances environmental management with energy and development needs. The project has also been designed in line with GEF Investment Guidelines for Sustainable Forest Management (SFM-1) and REDD+ Programme and supports the development of policies and regulations to rollout and implement SFM interventions that complement existing REDD activities in the country.

B.3 The GEF Agency's comparative advantage for implementing this project:

The proposed project is clearly within the comparative advantages of UNDP as stated in the GEF Council Paper C.31.5 "Comparative Advantages of GEF Agencies". UNDP has the ability to mobilize and make available quality technical expertise to develop policies and strategies (particularly in climate mitigation and adaptation, social sectors, governance and environmental management and risk disasters); knowledge and ability to take into account the rights and basic needs of the most vulnerable segments of the population; the ability of partner, mobilize and empower the communities and individuals to identify and own their problems and come up with pragmatic solutions; the focus on capacity building in all areas of support; and confidence among populations and national and international partners. UNDP has also developed and implemented several projects in Benin related to Energy and Environment, funded by both GEF and other donors.

UNDP has implemented over 230 GEF clean energy projects in close to 100 developing countries, and has acquired a unique base of institutional knowledge on transforming renewable energy markets in developing countries. UNDP has developed biomass electricity generation projects in India, Malaysia and Thailand. Two recent UNDP publications on de-risking renewable energy investment environments ('Transforming Renewable On-Grid Energy Markets' and 'De-Risking Renewable Energy Investment') summarize UNDP's empirically- and theoretically-robust 'theory of change' for catalyzing private-sector renewable energy investment.

This project also feeds under the UNDP-GEF EITT Signature program number 1 "SP1 – Clean Energy" Promoting access to clean and affordable energy systems and services. This signature program aims at improving the energy access, use and supply through the promotion of distributed clean energy systems, based mainly on hydro power plants for electricity generation. The project also feeds under the UNDP-GEF Ecosystem and Biodiversity Signature program number 3 "SP3 – Ecosystem based adaptation and mitigation" Managing and promoting ecosystems for adaptation to and mitigation of climate change.

In Benin, the project is line with the UNDAF 2014-2018 which is under development and which has a strong emphasis on poverty reduction activities and programmes. Renewable energy projects provide electricity to populations which otherwise might have not had access to energy and are therefore extremely helpful in reducing poverty.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the [Operational Focal Point endorsement letter\(s\)](#) with this template. For SGP, use this [OFP endorsement letter](#)).

NAME	POSITION	MINISTRY	DATE (MM/dd/yyyy)
Mr Delphin AIDJI	GEF Operational Focal Point and Secretary General of Ministry of Environment, Housing and Urban Development	MINISTRY OF ENVIRONMENT, HOUSING, AND URBAN DEVELOPMENT	MARCH 5, 2014

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for project identification and preparation.

Agency Coordinator, Agency name	Signature	DATE (MM/dd/yyyy)	Project Contact Person	Telephone	Email Address
Adriana Dinu UNDP – GEF Executive Coordinator and Director a.i.		March 21, 2014	Saliou Toure Regional Technical Advisor EITT	Tel. +221 33 869 07 89	saliou.toure@undp.org