United Nations Development Programme

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Project title: Promotion of small hydropower-based mini-grids for a better access to modern energy services in Central African Republic.		
Country: Central African Republic	**Implementing Partner:** UNDP (DIM modality)	**Management Arrangements:** Direct Implementation Modality (DIM)
UNDAF/Country Programme Outcome - CAF-Outcome 33: The population and public and private sector stakeholders utilise natural resources in more rational manner, improve food and energy security and are less vulnerable to crises.		
UNDP Strategic Plan Output – Output 1.5: Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy).		
UNDP Social and Environmental Screening Category: Moderate Risk	**UNDP Gender Marker:** GEN2: Gender equality as significant objective.	
Atlas Project ID/Award ID number: 00105867	**Atlas Output ID/Project ID number:** 00106888	
UNDP-GEF PIMS ID number: 5680	**GEF ID number:** 9291	
Planned start date: July 2018	**Planned end date:** June 2023	
LPAC date: 18 May 2017		

Brief project description:

This project aims to promote investment in small hydropower-based mini-grids to provide electricity services to the rural areas and formulate an appropriate business model that will ensure the sustainability of mini-grids based on small hydropower development in the country. It will do so by leveraging almost $ 16.7 million in multilateral and private sector financing over its five-year implementation period. Over the same period, 4 small hydropower stations will be developed to supply electricity services to an equal number of villages through mini-grids for income-generating activities and household/community use. Energisation of the villages will result in generation of some 39,770 MWh of electricity over the project timeframe and an annual generation of 14,535 MWh will be sustained over an expected 25-year projected life of the installations. This, in turn, will result in avoiding 35,000 tonnes of CO_2 during the 5-year project period and 13,000 tonnes of CO_2 thereafter annually over the remaining almost 21-23 years of the equipment useful life. Finally, over the 25-year projected lifetime of the equipment, 327,250 tonnes of CO_2 will be avoided. The project will achieve this target by introducing a conducive framework for investment promotion in small hydropower development and by establishing a financial instrument that together will facilitate private sector participation in village energisation through small hydropower mini-grids in the country.

FINANCING PLAN	
GEF Trust Fund	USD 2,645,000
UNDP TRAC resources	USD 500,000
(1) Total Budget administered by UNDP	**USD 3,145,000**
PARALLEL CO-FINANCING (*all other co-financing that is not cash co-financing administered by UNDP)*	
National Government (Ministry of Mines, Energy and Hydraulics) (Cash)	USD 600,000
Multilateral Development and Local Banks (through Ministry of Mines, Energy and Hydraulics) (Cash)	USD 9,000,000
Private Sector (Centrafric Global Business Consulting, Surl) (Equity)	USD 6,558,000
(2) Total co-financing	**USD 16,158,000**
(3) Grand-Total Project Financing (1)+(2)	**USD 19,303,000**

SIGNATURES		
Signature: print name below	**Agreed by Government**	**Date/Month/Year:**
Signature: print name below	**Agreed by Implementing Partner**	**Date/Month/Year:**
Signature: print name below	**Agreed by UNDP**	**Date/Month/Year:**

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List of Acronyms

AfDB	African Development Bank
APR	Annual Project Review
BEAC	Banque des Etats de l'Afrique Centrale (Bank of Central African States)
CO	UNDP Country Office
CO_2	Carbon dioxide
EIA	Environmental Impact Assessment
ENERCA	Energie Centreafricaine (Central African Republic Energy Company)
EU	European Union
FSM	Financial Support Mechanism
GEF	Global Environment Facility
GHG	Greenhouse Gas
IPP	Independent Power Producer
kW	Kilowatt
kWh	Kilowatt-hour
M&E	Monitoring and Evaluation
MMEH	Ministry of Mines, Energy and Hydraulics
Mtoe	Million tonnes of oil equivalent
MW	Megawatt
MWh	Megawatt-hour
NAPA	Nationally Adaptation Programme of Action
NGO	Non-Governmental Organisation
NSDP	National Strategic Development Plan
PANA	Programme d'Action Nationale sur l'Adaptation (National Adaptation Programme of Action)
QPR	Quarterly Progress Report
PIF	Project Identification Form
PIR	Project Implementation Review
PMU	Project Management Unit
PNAE	Programme National d'Action Environmentale (National Environmental Action Plan)
PPG	Project Preparation Grant
PV	Photovoltaics
REU	Rural Electrification Unit
RSC	UNDP Regional Service Centre
RTA	Regional Technical Adviser
TAF	Technical Assistance Facility
toe	Tonnes of oil equivalent
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
$	United States dollar[1]

[1] Exchange Rate: 1 $ = 610 FCFA (BEAC - XAF Feb 2017)

II. DEVELOPMENT CHALLENGE

The Central African Republic (CAR) is a landlocked country in Central Africa. It is bordered by Chad to the north, Sudan to the northeast, South Sudan to the east, the Democratic Republic of the Congo and the Republic of the Congo to the southwest and Cameroon to the west. The CAR covers a land area of about 623,000 square kilometres and has an estimated population of 5.1 million inhabitants (2016), with 39% living in the urban areas, against 61% in rural areas. Most of the CAR consists of Sudano-Guinean savannas, but the country also includes a Sahelo-Sudanian zone in the north and an equatorial forest zone in the south. Two thirds of the country is within the Ubangi River basin (which flows into the Congo), while the remaining third lies in the basin of the Chari, which flows into Lake Chad. Much of the country consists of flat or rolling plateau savanna approximately 500 metres above sea level, with the bulk of the northern half lying within the Sudanian savanna ecoregion. In addition to the Fertit Hills in the northeast of the CAR, there are scattered hills in the southwest regions. In the northwest is the Yade Massif, a granite plateau with an altitude of 348 metres. Much of the southern border is formed by tributaries of the Congo River; the Mbomou River in the east merges with the Uele River to form the Ubangi River, which also comprises portions of the southern border. The Sangha River flows through some of the western regions of the country, while the eastern border lies along the edge of the Nile River watershed. It is estimated that up to 8% of the country is covered by forest, with the densest parts generally located in the southern regions. The forests are highly diverse and include commercially important species of Ayous, Sapelli and Sipo – species of wood that are prized for their quality in the manufacture of furniture. The deforestation rate is estimated at approx. 0.4% per annum (FAO, 2015).

Fig. 1: Map of Central African Republic

The climate of the Central African Republic is generally tropical, with a wet season that lasts from June to September in the northern regions of the country, and from May to October in the south. During the wet season, rainstorms are an

almost daily occurrence, and early morning fog is commonplace. Maximum annual precipitation is approximately 1,800 millimetres in the upper Ubangi region. The northern areas are hot and humid from February to May, but can be subject to the hot, dry, and dusty trade wind known as the Harmattan. The southern regions have a more equatorial climate, but they are subject to desertification, while the extreme northeast regions of the country are already desert.

Despite its significant mineral deposits and other resources, such as uranium reserves, crude oil, gold, diamonds, cobalt, lumber, and hydropower, as well as significant quantities of arable land, the Central African Republic is among the ten poorest countries in the world. As of 2016 according to the Human Development Index (HDI), the country had the lowest level of human development, ranking 187th out of 187 countries. It is a Least Developed Country (LDC) that went through difficult periods of political instability and civil wars in the fairly recent past. The per capita income of the CAR is often listed as being approximately $450/year, one of the lowest in the world, but this figure is based mostly on reported sales of exports and largely ignores the unregistered sale of foods, locally produced alcoholic beverages, diamonds, ivory, bushmeat, and traditional medicine. Export trade is hindered by poor economic development and the country's landlocked position. Diamonds constitute the country's most important export, accounting for 40–55% of export revenues, with its largest export partner being Belgium, followed by China.

Country Situation and Development Context

Agriculture represents approx. 55% of the GDP and consists of the cultivation and sale of food crops such as cassava (manioc), cotton, peanuts, maize, sorghum, millet, sesame and plantain. The annual real GDP growth rate is just above 3%. The importance of food crops over exported cash crops is indicated by the fact that the total production of cassava, the staple food of most Central Africans, ranges between 200,000 and 300,000 tonnes a year, while the production of cotton, the principal exported cash crop, ranges from 25,000 to 45,000 tonnes a year. Food crops are not exported in large quantities, but still constitute the principal cash crops of the country, because Central Africans derive far more income from the periodic sale of surplus food crops than from exported cash crops such as cotton or coffee.

The primary energy supply of CAR in 2014 (the report that contains an analysis of 2014 raw data was issued in 2016) consisted of biomass (charcoal and fuelwood – 1,081,745 toe), petroleum products (43,503 toe) and electricity (11,959 toe) and their respective share in terms percentages is presented in Fig. 2 below.

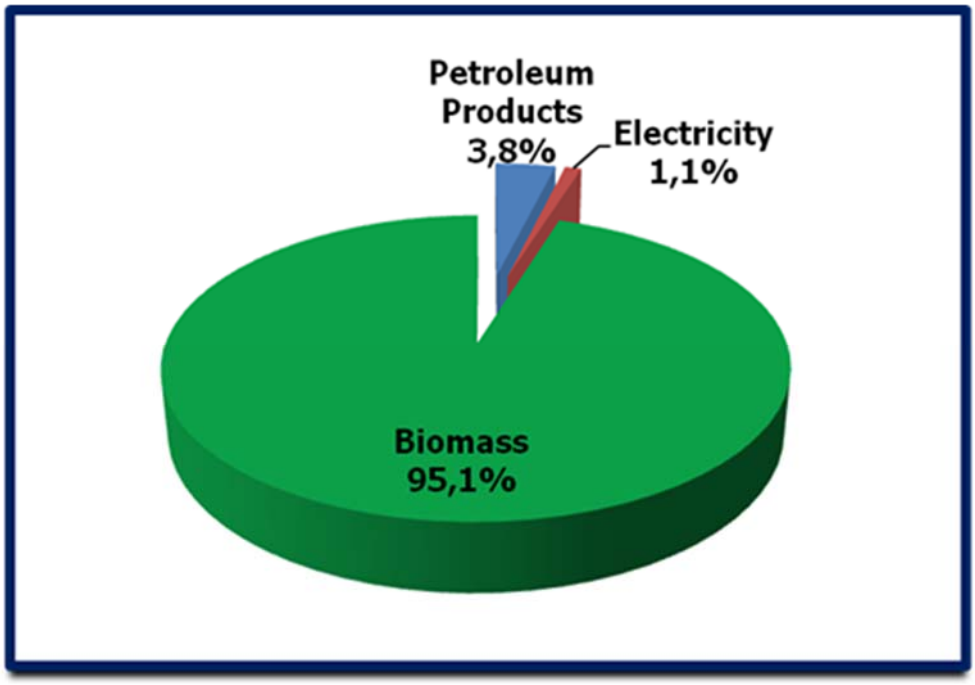

Fig. 2: Primary Energy Supply (2014)

The total primary energy supply is dominated by traditional biomass (wood, crop waste and dung) as the principal source of household energy, with its share representing 95% of the energy balance, and is utilised mainly for cooking. Modern forms of energy, such as petroleum products, including LPG, and electricity constitute the remaining 5%. With regard to energy consumption by sector (Fig. 3), in 2014 household energy use dominated at almost 92%, with the remaining 8% shared among Communications and Services (4.1%), Transport (3.4%) and Industry (0.6%).

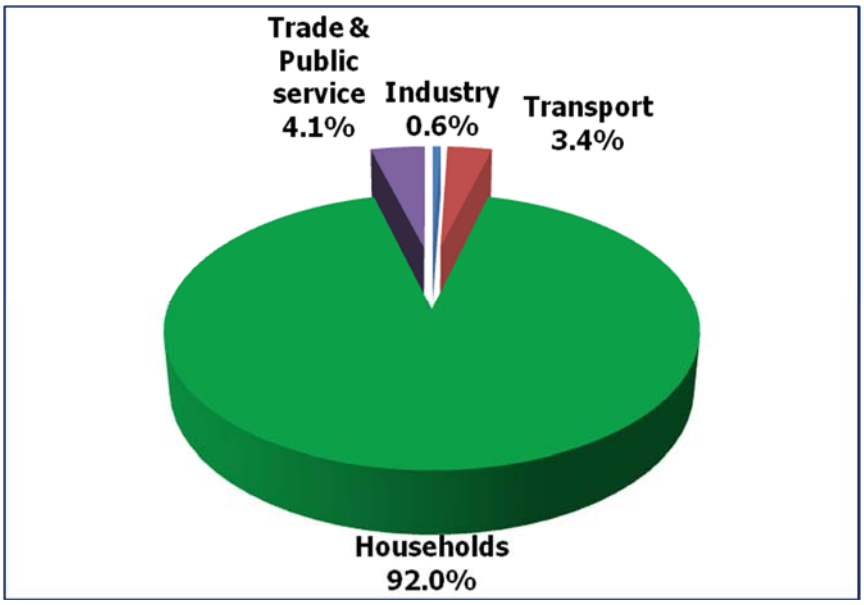

Fig. 3: Energy consumption by sector (2014)

In the peri-urban and rural areas, households mainly use charcoal or wood, and sometimes side by side on a charcoal stove and a 3-stone wood stove, for cooking. Charcoal is also widely used in the urban areas, as the supply of electricity and the availability of bottled gas tend to be erratic. As per available data (2014), almost 100% of rural households use exclusively fuelwood and 20% of urban households use fuelwood and/or charcoal for cooking and this massive use of biomass contributes to rapid depletion of the country's forestry resources, leading to deforestation. In this connection, it is estimated that wood consumption in CAR is approx. 1.6 million tonnes per year. Approximately 8% of the population has access to clean fuels (electric stoves and bottled gas - LPG) for cooking and very little cooking (and lighting) is done with paraffin, locally known as "pétrole lampant". In fact, paraffin used to be the fuel of choice for lighting in the rural areas, but is being gradually replaced by disposable (non-rechargeable) battery-operated LED lamps, commonly known in the rural areas of the country as "branchements" or "Chinese lamps", reflecting the country of manufacture of the "recycled" LEDs (Photo 1).

Photo 1: “Branchement” utilising AAA batteries and LEDs (Courtesy: Rigobert Gbazi)

With regard to petroleum products, they account for just under 4% of the energy balance, mainly used for transport and electricity generation in Bangui and Prefectures/Sub-Prefectures. CAR has one of the lowest electricity access rates in the world, covering only 2.5% of the population. This percentage is a national average that varies widely among the country’s 16 Prefectures and 66 Sub-Prefectures. For example, the access rate is 21% (2014) in Bangui (the capital), about 1% in the Prefectural “chefs-lieux” (centres) and virtually inexistent in rural areas although, as indicated above, 61% of the population lives in the rural areas. This very unusual situation is the result of several factors, including the fact that the majority of the population lives in absolute poverty with an average income of less than $1/day/inhabitant, armed conflicts over the last two decades and the accompanying political and institutional instability.

Electricity Supply

Electrical power in the country is provided by the national power utility ENERCA (Central African Republic Energy Company), which has the mandate to produce, transmit, distribute and market electricity throughout the country. ENERCA is a public company that was established in 1963 and is fully owned by the Government. It’s total installed generation capacity (Tables 1 and 2) is 32 MW, consisting of 18.75 MW of hydro and 8.5 MW of diesel plants in Bangui and 4.8 MW of diesel plants in the Prefectural/Sub-Prefectural Centres. However, as of December 2016, only a total of approx. 24 MW of combined hydro and diesel generation capacity was operational throughout the country. The total annual electricity generation of 140 GWh has been almost constant over the last few years, inclusive of 2016.

Table 1: Installed and available generating capacity for Bangui (December 2016)

Type	Location	Distance from Bangui (km)	Installed Capacity (MW)	Available Capacity (MW)	Present Status
Hydro	Boali 1	95	8.75	8.75	Operational – replacement of turbines completed in 2016.
Hydro	Boali 2	95	10	10	Operational.
Hydro	Boali 3	95	0	0	New 10 MW turbine and generator replacement units required.

Diesel	Bangui	0	2.5	2.5	Operational.
Diesel	Bangui	0	2.5	2.5	Operational
Diesel	Bangui	0	3.5	0	Under maintenance
TOTAL			**27.25**	**23.75**	

Table 2: Installed and available diesel generating capacity at Prefectural (P)/Sub-Prefectural Centres SP) (December 2016)

N°	Diesel	Distance from Bangui (Km)	Date of commissioning	Installed Capacity(kVA)	Comments
1	Bambari (P)	385	1970	250	Vandalised
				650	
2	Bangassou (P)	742	1981	160	Available
3	Berbérati (P)	580	1971	600	Out of operation
				800	Available
4	Boda (SP)	192	1996	180	Out of operation
5	Bossangoa (P)	305	1970	250	Available
				150	Out of operation
				650	Out of operation
6	Bouar (P)	454	1952	625	Out of operation
				125	Available
7	Bozoum (P)	384	1975	160	Out of operation
				85	Out of operation
8	Carnot (SP)	492	1971	500	Out of operation
9	Kaga–Bandoro (P)	342	1999	160	Vandalised
10	Kembé (SP)	613	1985	100	Available
11	M'baïki (P)	107	1969	125	Available
12	Mongoumba (SP)	189	1975	50	Out of operation
				50	Out of operation
				44	Available and Operational
13	Ndélé (P)	645	1970	50	Vandalised
14	Paoua (SP)	506	1996	150	Available
15	Sibut (P)	185	1982	110	Out of operation
TOTAL				**6,024 kVA equivalent to 4.8 MW**	

(P) – Prefecture (SP) – Sub-Prefecture

In addition to the information provided in Table 2 above, the Sub-Prefecture of Gamboula has an operational 120-kW mini hydropower station at Gamboula (see Table 6 below) that was built in 1986 by Swedish missionaries (registered as an NGO) and the electricity generated powers the hospital, seminary and staff residences through a local distribution grid; however, the potential exists to increase the installed capacity by 300 kW to a total of 420 kW to supply the population of the Sub-Prefecture consisting of over 2,500 households.

The country possesses a potential of over 2,000 MW of hydropower resources, but only a very small 1% of this potential has been developed. These, together with the diesel power stations in the country, are (Tables 1 and 2):

- The hydroelectric power plants of Boali 1 (8.75 MW) and Boali 2 (10 MW), were built in 1954 and 1976 respectively on the Mbali river. Since then, these plants have undergone some partial rehabilitation. Unfortunately, they are today in a state where they have well passed their useful lives.

- Boali 3: The dam was built in 1991 with the objective of storing water to regulate the Mbali flow that would allow both Mbali 1 and 2 to maintain electricity generation throughout the year and it continues to play this role. In addition, it was planned to install 2 x 5 MW generators at the dam and construction works commenced in 2012. Unfortunately, because of the situation then prevailing in the country, all further construction works were stopped; negotiations are presently under way with the Government of China for installing the 2 turbine-generator sets.

- The 8.5 MW Bangui diesel power plant consisting of 3 units (G3 – 2.5 MW, G4 – 2.5 MW, both built in 1984, and G5 – 3.5 MW built in 1976) was designed to supplement the Boali plants. Rehabilitation of the 3.5 MW G5 unit is presently on-going. In addition, there is a G6 unit of 6.3 MW that was installed in 1991, but it has been out of operation for quite some time due to technical problems.

- Fifteen (15) Prefectural/Sub-Prefectural centres (the 16th Sub-Prefecture has the NGO-operated 120-kW hydropower station at Gamboula that supplies only infrastructure associated with the work of the Swedish missionaries, but not the village population) supplied by ENERCA's isolated diesel generators have a total installed capacity of approx. 4.8 MW operating only four hours a day, from 6 to 10 p.m. Of these, the generators at 3 centres have been vandalised, several others are technically available but are not operating due to insecurity and/or lack of fuel, with the result that only the 44-kVA unit at the Mongoumba Sub-Prefectural centre is presently operational.

Transmission of electricity from the power stations serving Bangui is through 63 and 110 kV lines (Table 3). In addition, the distribution network in Bangui and the Prefectural/Sub-Prefectural Centres consists of 265 km at 15 kV and 300 km at 400 V, with substantial lengths of lines being out of service due to vandalism.

Table 3: Transmission Lines Overview

Line	Year of Construction	From	To	Line Length	Voltage
Line 1	1953	Boali 1	15 MVA Substation	81 km	63/15 kV
Line 2	1976	Boali 2	15 MVA Substation	83 Km	110/63/15 kV
Interconnection No. 1		Boali 1	Boali 2	1 Km	63 kV
Interconnection No. 2		15 MVA Substation	10 MVA Substation	7 Km	63 kV

Table 4 below provides figures of total electricity generation in the country, with a breakdown between hydro and thermal sources; it is noted that, over the years, 96% - 99% of electricity generated in the country has been and still is from hydro resources.

Table 4: Electricity Generation

Year	Hydro Generation (MWh)	Thermal Generation (MWh)	Total (MWh)
2007	136,840	250	137,090
2008	125,486	365	125,851
2009	136,368	323	136,691
2010	136,614	298	136,912
2011	139,045	417	139,462
2012	139,745	305	140,050
2013	136,920	701	137,621
2014	138,834	230	139,064
2015	137,000	384	137,384
2016	134,320	170	139,490

The Government reformed the electricity sector in 2005 and established an Electricity Code. This reform was aimed at improving the climate for and opening up the electricity sector to private investment in generation, transmission and distribution while maintaining the interests of the State through ENERCA. It also defined respective responsibilities among electricity producers, distributors and consumers and established a tariff structure. However, as several of the regulations accompanying the Electricity Code have yet to be approved by the Government, there has been no uptake in either electricity generation or distribution by the private sector. With regard to ENERCA, it is only able to supply electricity in Bangui for about 8 hours per day due to lack of adequate installed capacity. In addition, ENERCA continues to be plagued by several problems related to, among others, recurring negative commercial performance, outdated equipment and high transmission/distribution losses.

The domestic sector (households) is the biggest electricity consumer at 53% followed by the services sector at 27% and industry at 20% (2014). The annual per capita electricity consumption is 28 kWh (Energy Information Report, 2016), significantly below the African average of 579 kWh and the world average of 2,777 kWh. Only 25 % of consumers have electricity meters installed at their premises; in the absence of metering, the remaining 75% are billed a flat rate. While the billing rate is estimated at 95%, the recovery rate is only 40%, thus resulting in high non-technical (commercial) losses. These, together with technical losses in the ENERCA distribution system, reach a high of 42%.

With regard to the rural areas of the Prefectures/Sub-Prefectures, some initiatives have been implemented by private businesses (religious groups, agro-based industries, saw mills and vegetable/fruit growers) to generate electricity through individual diesel-powered generating sets ranging from 2 to 650 kVA and, in some rare cases, through hydropower or solar PV. One example is that of the mini hydropower station built in 1986 in the Sub-Prefecture of Gamboula located some 680 km from Bangui at the border with Cameroon. Swedish missionaries built the 120 kW on a branch of Kadeï River and the electricity generated powers the hospital, seminary and staff residences. With regard to PV in the Prefectures/Sub-Prefectures, they have been installed by the mobile phone service providers to power transmitters for mobile communications.

As of December 2016, ENERCA had a client base of more than 30,000 customers (comprising 99% households and 1% in other categories) sub-divided into various different tariff categories (Table 5), in the range of 10 – 14 Cents/kWh for various categories of consumers. As an indication, the cost of thermal generation at the busbars of the diesel power stations

was 23 US Cents/kWh in 2016 (not including the cost of delivery to consumer premises), while the cost of generation at the Boali 1 hydropower station that was refurbished in 2016 is computed at 2 - 3 US Cents/kWh by ENERCA.

Table 5: Electricity Tariff Structure (December 2016)

Category		Price per kWh, inclusive of VAT		Tariff Modality
		F CFA	US $	
Low Voltage	**Lighting**			
	Tranche 1	76.56	0.13	For the first 50 hours of use of the subscribed capacity.
	Tranche 2	82.70	0.14	From the 51st hour to the 100th hour of use of the subscribed capacity.
	Tranche 3	89.31	0.15	From the 101th hour of use of the subscribed capacity.
	Power Usage			
	Tranche 1	64.60	0.106	For the first 65 hours of use of the subscribed capacity.
	Tranche 2	69.76	0.114	From the 66th hour to the 95th hour of use of the subscribed capacity.
	Tranche 3	75.35	0.123	From the 96th hour of use of the subscribed capacity.
	Mix of Lighting and Power			
	Tranche 1	75.53	0.12	For the first 65 hours of use of the subscribed capacity.
	Tranche 2	81.57	0.13	From the 66th hour to the 130th hour of use of the subscribed capacity.
	Tranche 3	88.10	0.14	From the 131th hour of use of the subscribed capacity.
Public Lighting		69.92	0.11	
Medium Voltage	Fixed Charge	2,749.50		Per kW of subscribed maximum demand.
	Day Use	42.30		Between 6 am and 10 pm.
	Night Use	30.38		Between 10 pm and 6 am.

	Reactive Power	37.58		Per kVA when power factor drops under 0.8.
	Penalty	26.15		Per kW of exceeding subscribed maximum demand.
Secondary Centres		160.84		Tariff utilised in the 15 Prefecture Centres.

ENERCA's accounts for the last five years are yet to be certified. However, from data available as of 31 December 2016, the main financial indicators show a turnover of $ 8.7 million (5.3 billion FCFA), net proceeds of $ 660,000 (403 million FCFA), debts of $ 62,800 (38.3 million FCFA) and equity $ 7.1 million (4.35 billion FCFA). Accounts receivable from customers in respect of unpaid bills have increased from $ 3.59 million (21.88 billion FCFA) in 2010 to $ 4.87 (29.7 billion FCFA) in 2016. No systematic review has been done by ENERCA to determine the average duration of unpaid invoices; however, they likely exceed the 60-day norm and are estimated to be in the neighbourhood of 90 days. Unfortunately, the current country situation does not allow for decreasing the period for accounts payable. In 2015, ENERCA's debts amounted to $ 82 million (50 billion FCFA) and the amount it was owed by its customers amounted to $ 46 million (28 billion FCFA). However, as electricity from hydropower generation by far exceeds that of diesel (see Table 4 above), ENERCA's balance sheet should have projected a positive picture, absent the significant commercial losses that plagues its operations.

Renewable Energy Sector

At the present time, there exists no Government policy nor a defined framework for renewable energy (hydro, biomass, solar, wind, etc.) development in the country, although the Electricity Code does indicate that the private sector can utilise hydropower for decentralised rural electrification. This absence of a policy/defined framework is despite the fact that the country possesses very good hydro and solar resources that can be further developed to put it on a sustainable energy development path. However, there exist a very few "self-generators" who meet their demand for power through renewable energy solutions such as solar kits, the already-mentioned small hydro power plant in Gamboula in the West and biomass (bagasse) at sugar factories. UNDP has also piloted the installation of solar kits in 7 villages through its "Solar energy electrification of seven villages in CAR" project.

Hydropower[2]

The hydro power potential in the Central African Republic, as indicated above, is estimated at 2,000 MW, inclusive of the 18.75 MW that are presently being exploited. Hence, the scope for harnessing hydropower resources for electricity generation is tremendous (Table 6), but the bottleneck has been lack of Government resources and the absence of a clear policy that will promote and facilitate private sector participation in this sub-sector.

Table 6: List of Identified Small Hydropower Sites and Potential Power Generation

N°	Site (Prefecture/Sub-Prefecture)	Capacity (kW)	Type
1	Kaga-Bandoro	1,929	Small SHP
2	Soumbé	1,700	
3	Mbaéré-SIPLAC	1,080	

[2] Unless otherwise indicated, the term "small hydropower (SHP)" in this document is used to encompass pico (≤ 5 kW), micro (5 kW – 100 kW), mini (100 kW – 1,000 kW) and small (1,000 kW - 10,000 kW) hydropower stations.

4	Ngotto (Ile buffles rouges)	1,000	
6	M'Bécko (Mbaiki)	600 (Feasibility Study available)	Mini SHP
7	Toutoubou (Carnot)	759 (Feasibility Study available)	
8	Nana (Carnot)	720	
9	Gbassem (Boda)	550 (Feasibility Study available)	
10	Baidou-Bac (Bambari)	600 (Feasibility Study available)	
11	Mambéré	400	
12	Gamboula (Mambéré Kadeï)	120 (existing) + 300 (new)	
13	Mangouloumba	263	
14	Dimbi	160	
15	Pont (Baoro)	72	Micro SHP
16	Dédé Mokouba	25.6	
17	PK 45 (Gba)	22	
18	Guifa	6	
19	Maigaro	5	
20	Gbango	4.8 (Feasibility Study available)	Pico SHP
21	Maigaro 1	4	

Source: Ministry of Mines, Energy and Hydraulics, 2016

The feasibility studies that are available for sites No. 6,7, 9,10 and 19 in Table 6 above were undertaken in 1993 by Group Consulting Engineers Salzgitter GMBH and Electricité de France. Since then, no further action regarding development of any of these sites has been implemented nor has the feasibility studies been updated. However, these sites do present the advantage that a large amount of technical information is already available and, in case any of them is selected for development, updating the feasibility study will necessitate a shorter time-frame and less resources than required for the other sites.

Solar Energy

CAR has also good solar energy resources with an average of 7 hours of sunshine per day throughout the year and an average insolation level of 5 kWh/m^2/day. Average monthly values of solar radiation indicate that they are lowest (4.5 kWh/m^2/day) in the south-western part of the country (Bangassou, Bangui et Berberati), medium (5.5 kWh/m2/day) in the centre (Bambari, Bossangoa) and high (6.5 kWh/m^2/day) in the north (Ndélé and Birao). Hence, solar energy is considered as having a good potential in the North, but can also be utilised in the other regions for low power applications, especially in the rural areas away from the grid. In fact, some "higher-income" households have purchased solar kits for lighting, charging mobile phones and watching TV during black-outs and, as indicated earlier, mobile phone companies power some of their transmitters through PV.

Within the framework of a grant from the People's Republic of China in the amount of approx. $ 1 million, 200 street lights were installed in Bangui in June/July 2016. In addition, in order to provide relief from load shedding in the capital city, the CAR Government signed on 29 April 2016 an agreement with Power China for a feasibility study for a 50-MW grid-connected central PV station at Bimbo near Bangui. As per the feasibility study that was undertaken by HydroChina (a Chinese Consulting Company that also works on Solar PV) and completed in November 2016, the total investment for a 50.34 MW will amount to $ 167 million and 67 GWh will be injected into the grid annually at a cost of $ 0.20/kWh,

excluding VAT. Following the feasibility study, Power China is seeking funding, on behalf of the Government, to implement the project.

Other PV projects implemented in rural areas by ACER (Autonomous Agency for Rural Electrification – see below) since its establishment in 2005 and directly by the Ministry of Energy prior to that under donor assistance programmes include:

- Street lighting and solar kits with funding from Japan in 1988 in Damara, some 75 km north of Bangui;
- A 1.1 kW solar water pump installed by UNICEF in 2007 in Ndomété, a village located some 10 km from Kang-Bandoro, the Prefectural centre of Nana-Gribizi;
- The "Seven Villages Project" funded by UNDP in May 2010 in the villages of Imohoro, Pata, Liby, Féré, Mabo, Galafondo and Ouaoua that involved the distribution of solar kits to community/health centres, schools and markets.

Unfortunately, it has been reported that all the equipment provided under these initiatives met the same fate of being vandalised by armed groups in 2012.

Contrary to the situation in many African countries, there does not exist in CAR a robust market for Solar Home Systems (SHS). However, because of the unavailability of electricity services, some households and small enterprises have installed low-quality SHS utilising 12 V car batteries and these are prone to frequent failures. In view of the low income level in the peri-urban and rural areas, the market for SHS is unlikely to take off in the absence of financial incentives.

Wind and Geothermal Energy

Very little data is available that can validate the potential for utilising any of these two resources for electricity generation.

No studies have been undertaken to determine the wind power potential in the country; hence, there are no hard data to work with to forecast any electricity generation from wind. However, a wind map for the whole of Africa prepared jointly by the Agence Française de Développement and the African Development Bank in 2009 indicates an average wind speed of 4 m/s at a 50-m height for CAR; this is a very low speed that does not lend itself for bulk electricity generation from wind. In addition, a report prepared as an input to the CEEAC (Economic Community of Central African States)/CEMAC (Central African Economic and Monetary Community) White Paper 2013-2030 entitled "Regional Policy for Universal Access to modern energy services and socio-economic development" indicates that "The application possibilities for wind energy (in the Central African Republic) are very limited due to generally low continuous wind speeds and the frequent periods of lull". The only reported example of wind power utilisation is the installation of a wind pump by a private party for mechanical village water pumping in the region of Ngaoundaye located in the north-western part of the country.

In light of the above, it might be worthwhile to initiate a serious study to determine the wind power potential in the various regions of the country to ascertain the share of wind energy, if any, in the country's decentralised energy strategy for the rural areas.

With regard to geothermal energy, some sites have been identified in the zones of Dissikou (Dékoa) and d'Ambilo (Nzako) due to the presence of hot springs. Similar to the case of wind energy, no studies have been undertaken for the utilisation of geothermal energy for electricity generation in the country.

Biomass and Bio-Fuels

The use of by-products from the forestry industry and agricultural residue may present a case for electricity generation from biomass, in addition to bagasse that is already utilised at a sugar factory. For example, SCAD, a private company

involved in the "forestry" industry has a 750-kVA generator operating on by-products from a saw mill to generate electricity for its own use (the boiler is presently out of commission). In addition, SUCAF, a sugar factory in the village of Ngakobo located some 25 km from Bambari, utilises bagasse and cotton seeds to operate a 1.6 MW generator. However, like in the case of wind and geothermal energy, there are no hard data that can assist in determining the biomass potential of the country for electricity generation. Of course, as indicated earlier, 95% of the population already rely on biomass in terms of charcoal and wood as fuel for cooking.

With regard to bio-fuels, the Government launched the process of its development through the adoption of Law 08.018 of 6 June 2008 designed to regulate activities in this field. Unfortunately, implementation of this Law is not yet effective, due to the absence of the required "accompanying" decrees/regulations.

1.1 Stakeholder Analysis and Institutional Framework

- **Ministry of Mines, Energy and Hydraulics**

The Ministry of Mines, Energy and Hydraulics (Fig.4) has the overall responsibility for formulating, implementing and monitoring policy in the energy sector. In accordance with Decree N° 16.349 of 11 October 2016 that relates to the organisation and functioning of the Ministry, it exercises its role through 2 distinct Directorates, viz. Directorate General for Energy and Directorate General for Petroleum. The functions of each Directorate General are described below:

- **Directorate General for Energy**

The Directorate General for Energy is directly responsible for implementing the Government's energy policy and accomplishes this through its Directorate for Conventional Energy (for activities related to Electricity Services, Energy Management and Energy Efficiency), the Directorate for New and Renewable sources of Energy (for activities related to the promotion of Hydro electricity generation, Bioenergy, Geothermal Energy, and Solar and Wind Energy) and the Directorate for Studies, Statistics and Planning (for activities related to Statistics and Documentation, Studies, Planning and Energy research, and Coordination, Monitoring and Evaluation of programmes and projects).

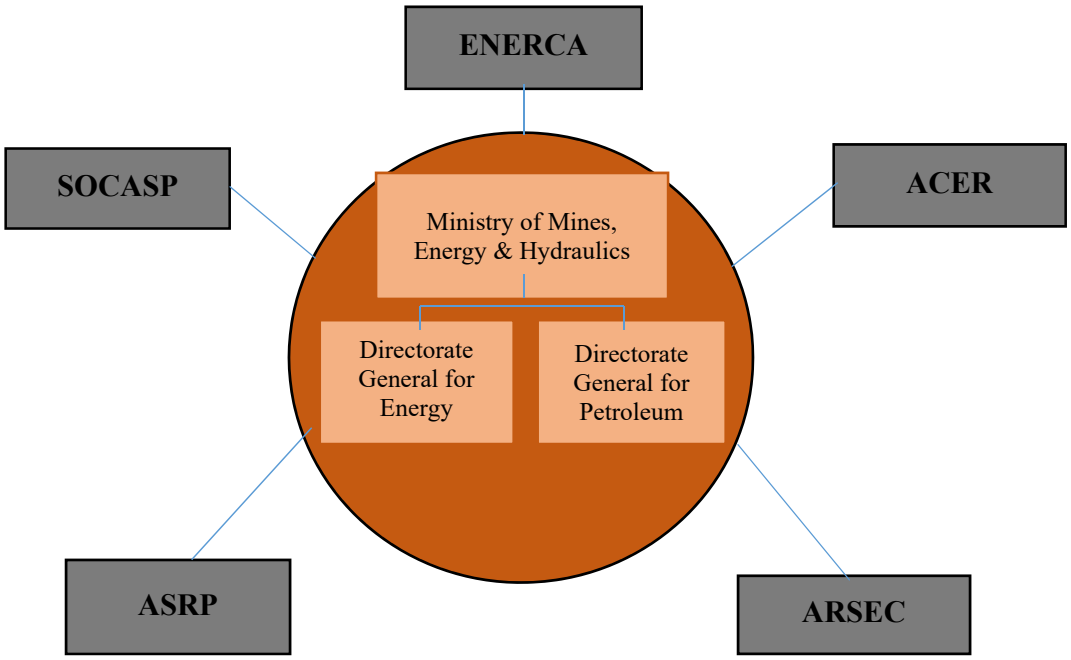

Fig. 4: Ministry of Mines, Energy, and Hydraulics Organisational Chart

The following three Agencies/Institutions in the electricity sub-sector operate under the responsibility of MMEH, in close cooperation with the Directorate General for Energy:

(i) ENERCA (Énergie Centrafricaine – Central African Electric Utility). ENERCA is a Government body established by decree N° 68/048 of 12 January 1968 with the exclusive mandate to generate, transmit, distribute and commercialise electricity throughout the country. However, as indicated earlier, the electricity sub-sector was "liberalized" on 1 January 2005 with the promulgation of Ordinance N° 001/05 related to the Electricity Code that opened up the sub-sector to other operators to generate, transmit, distribute and commercialise electricity anywhere in the country. However, as the accompanying decree and several regulations are yet to be approved, no other operator has stepped up to the plate to date, with the result that ENERCA still remains the sole operator and, thus, maintains its de facto monopoly.

(ii) ARSEC (Agence Autonome de Régulation du Secteur de l'Électricité en République Centrafricaine - Autonomous Agency for Regulation in the Electricity sector of the CAR). ARSEC derives its mandate from Ordinance No 05.001 of 1 January 2005, but became operational only when Decree No 09.046 of 2 February 2009 was issued to regulate its functions. ARSEC's mandate is to ensure regulation, control and monitoring of activities in the electricity sub-sector. It is also tasked with supporting the energy needs of consumers within a sustainable development context, bearing in mind economic, social and environmental issues, ensuring the streamlined and economically viable development of electricity services for industries, promoting competition in generation, transmission, distribution and sale of electricity, establishing electricity tariffs, etc.

(iii) ACER (Agence Autonome d'Électrification Rurale de Centrafrique – Autonomous Agency for Rural Electrification). ACER was established under Decree No 05.273 on 11 September 2005 and has been functionally operational since 2008. Its mandate is to implement Government policy, through the promotion of simplified procedures, that facilitates promotion and development of rural electrification. It is tasked to support developers in the implementation of rural electrification programmes and consumers in the utilisation of electricity services.

Unfortunately, due to the lack of sufficient support from decision makers and the absence of a regular financial resource stream, ACER is yet to implement its first village electrification project, although it has installed, as mentioned above, a few PV street/outdoor space lighting systems under donor-funded programmes. In this connection, the recently-published (January 2017) Technical Assistance Facility (TAF) report prepared by the European Union within the framework of Sustainable Energy for All (the report will serve as an input towards the formulation of the European Development Fund next assistance cycle (EDF-11) notes that "The absence of a real energy policy has largely contributed to the inaccessibility to modern energy sources by the poor, particularly regarding rural electrification, that relates to the needs of 2/3 of the CAR population. It is indispensable to formulate a rural electrification policy and strategy, as well as an Energy Master Plan for CAR".

With regard to petroleum products and bio-fuels, the Directorate General for Energy is also responsible for all "downstream" activities related to finished products up to the point of utilisation (as opposed to the Directorate General for Petroleum that has "upstream" responsibility related to oil exploration, exploitation, transportation of crude oil and refining – at the present time, the country is still at the oil exploration stage). It accomplishes this supervisory responsibility through the following 3 Agencies:

(i) SOCASP (Société Centrafricaine de Stockage des Produits Pétroliers – Central African Company for Storage of Petroleum Products). SOCASP was established under Law N° 07.007 of 24 April 2007 and has, among others, the following objectives:

- Exclusive responsibility for storage, reception and handling of all petroleum products and their derivatives commercialised in CAR;
- Importation of all petroleum products and their derivatives for secure storage;
- Quality control of all petroleum products and their derivatives that are available for sale on the local market;

- Siting, rehabilitation and construction of all infrastructure for secure storage of all petroleum products and their derivatives;
- Organisation and procurement of all petroleum products and their derivatives, etc.

All petroleum products and gas presently consumed in the country are imported. In 2016, the country imported 76.37 Mtoe, equivalent to 15 toe/person/year. The consumption of petroleum products alone in 2016 amounted to 76.32 Mtoe, with the remaining 0.05 Mtoe attributed to gas (equivalent to a per capita consumption of 10 kg/year), thus confirming that the share of gas among the imported sources of energy is negligible.

(ii) ASRP (Agence de Stabilisation et de Régulation des Prix des Produits Pétroliers – Agency for Stabilising and Regulating Prices of Petroleum Products). ASRP was established under Law N° 07.006 of 24 April 2007 with the dual objective of stabilising and regulating the prices of petroleum products and their derivatives throughout the country. It is responsible for providing transparency in petroleum products pricing, for control of installations and operations of the supply chain, for support to operators in the sub-sector in securing competitive prices from suppliers, for quality control of petroleum products and its derivatives in the market, etc.

(iii) APB (Agence de Promotion des Biocarburants – Agency for the Promotion of Bio-fuels). As indicated earlier, the Government has launched the process for developing bio-fuel through the adoption of Law 08.018 of 6 June 2008 to regulate activities in this field. Unfortunately, implementation of this Law is delayed, due to the absence of the required accompanying decrees to establish its operations.

- **Investment Charter/One-stop Shop**

In addition to the above Directorates, the CAR Government established the « Charte des Investissements » (Investment Charter) on 16 July 2001 (Law No. 01.010) with the objective to support and promote investment in the country for developing income-generating activities that would add value to local raw material, both for the local market and for export, and to create sustainable jobs. This investment charter, under the responsibility of the Ministry of Commerce and Industry applies to all industrial, small and medium enterprises, with the exception of forestry, mining and tourism that are governed under other specific Ordinances.

The Investment Charter established a One-stop Shop for business development (Le Guichet Unique de Formalités des Entreprises en République Centrafricaine (GUFE-RCA)) that reflects the Government's desire to improve procedures with regard to establishing enterprises through streamlining of the administrative procedures and reducing the timeframe for processing applications. In this connection, the mission of GUFE-RCA is to, among others:

- Simplify procedures and formalities for establishing, amending, winding down or dissolving activities of enterprises;
- Contribute to the improvement of the business climate to make it attractive for investment; and
- Contribute to welcoming, informing, orienting and advising local and foreign investors.

1.2 National Strategies and Plans

National Plan for Recovery and Consolidation of Peace (Plan national de relèvement et consolidation de la paix - RCPCA) 2017 – 2021.

In order to avail itself of the window of opportunity provided by the present situation in the country to lay down solid bases for a fresh start, the Government has formulated a National Plan for Recovery and Consolidation of Peace (RCPCA) for the period 2017-2021 in order to define its intervention and that of its development partners over the next five years. The Government's vision through implementation of RCPCA is that of a country that has achieved peace, that is pursuing the dialogue for reconciliation, that has established concrete milestones on the road to solid peace and initiated a process of recovery and sustainable development.

The document that was presented at the Round Table held in Brussels on 17 November 2016 revolves around three priority pillars: (i) support peace, security and reconciliation, (ii) renew the social contract between the State and the population, and (iii) ensure economic recovery and jump-start the productive sectors. Each pillar revolves around a number of specific strategic objectives, themselves broken down into results and priority strategic activities. In addition, six cross-cutting objectives are dealt with in their totality of actions, reflecting the immense magnitude of the structural challenges facing CAR, to mitigate regional disparities, promote gender equality, strengthen transparency and acceptability at all levels; develop national capacities (public administration and civil society); promote the inclusion of the youth; ensure viability of the environment and sustainable exploitation of natural resources. The financial requirements to implement all these were estimated at $ 3.161 billion, of which the donor conference mobilised $ 2.20 billion.

National Energy Policy

The Government approved, among others, Ordinance N° 05.001 of 1 January 2005 on the Electricity Code aimed at liberalising the Electricity Sub-Sector, Laws N° 07.005, N° 07.006 and N° 0.007 of 24 April 2007 on reorganizing the Petroleum Sub-Sector, establishing ASRP and SOCASP, respectively, and Law N° 08.018 of 18 March 2010 on Bio-Fuels. Following these, the Government issued Decree N° 10.092 on 18 March 2010 that made public its National Energy Policy (NEP).

The overall objective of the National Energy Policy is to "contribute to economic growth, to improve the quality of life through the increase in the electricity access level and to ensure energy independence in security of energy supply through interconnection with other countries". This overall objective is accompanied by 5 specific objectives, viz:

1. Improve institutional capacities to strategically manage the energy sector;
2. Guarantee continuity in energy supply to all enterprises and households throughout the country on a competitive basis;
3. Ensure protection of the people, property and environment against the risks arising from activities in the field of energy;
4. Ensure independence and security in energy supply in the country; and
5. Ensure governance in the energy sector within the framework of a sub-regional, regional and international interconnected system.

The guiding principles of the National Energy Policy takes into account economic competition and profitability, living environment, national independence, public-private partnerships, programmatic and participatory approaches, etc. The Government has for some time been contemplating the idea of revising/updating the National Energy Policy, but no time-frame has yet been proposed.

Decentralised Energy Policy (Draft, 2017)

The overall objective being pursued by the Government in the electricity sub-sector is to significantly increase access to reliable electricity services to urban, peri-urban and rural populations at an affordable cost and to stimulate economic growth through promoting public- private sector partnerships. Towards this end, the Government has recently (February 2017) formulated a draft "Decentralised Energy Policy" (DEP) in which it elaborates its overall objective "to guarantee access to efficient, sustainable and modern energy services to the rural population by 2030 and at an affordable cost". This demonstrates its undertaking to implement the 2030 Agenda for Sustainable Development (Sustainable Development Goals) and, specifically, SDG No. 7: Affordable and Clean Energy - Ensure access to affordable, reliable, sustainable and modern energy for all. Achievement of this goal starts with clarifying and consolidating the legal and institutional framework of the electricity sub-sector, sharpening the roles of the main stakeholders and mobilizing financial resources. It hence proposes to implement specific activities aimed at putting the country on a trajectory of achieving SDG 7 within the defined timeframe.

With regard to the specific objectives of DEP, they are as follows:

- Promote legal and institutional capacity adapted for decentralising and disseminating electricity services;
- Provide access to electricity services to all rural and urban residents at an affordable cost;
- Ensure coherent and coordinated management of the electricity sub-sector at the regional and local levels; and
- Protect the environment against the risks associated with activities in the field of energy through a reduction in deforestation and GHG emissions.

This draft Decentralised Energy Policy document is presently being discussed at various Government levels and with different stakeholders outside of Government. It is expected that it would be formally approved by the Government during the course of this year (2017).

Master Plan for Generation and Transportation/Distribution of Electricity, 1992:

Within the framework of planning the development of the electricity sub-sector in CAR, ENERCA commissioned a study in November 1992 to formulate a master plan for electricity generation, transmission and distribution for the next 15 years. This study was undertaken by SOGREAH et ELECTROWATT and dealt with the evolution of the Bangui interconnected grid. The study also looked at the then 12 secondary centres, together with a specific study for the one closest to Bangui. Simulations were undertaken for the period 1992-2012 on the basis of low, medium and high demand growth.
Since then, ENERCA has not updated this master plan to cater for future years.

National Adaptation Programme of Action (PANA : Plan d'Action Nationale d'Adaptation au Changement Climatique).

The CAR prepared a National Adaptation Programme of Action against Climate Change (NAPA) in 2008 with the support of UNDP, not only to meet its obligations under UNFCCC, but also to set priorities for action and to integrate climate change concerns into national and sectoral development plans and programmes. The sectors that were assessed during the NAPA process included water, forestry, agriculture, health and energy. Priority actions were identified and defined, but, unfortunately, no funding could be mobilised to implement them.

In October 2011, in connection with the initiative of "Reducing Emissions from Deforestation and Forest Degradation" (REDD), the Government formulated and submitted its Readiness Preparation Proposal (RPP) to the donor community. Following revisions to the document to incorporate comments received, the final version was submitted to the World Bank in March 2013. Funding in the amount of $ 10 million was mobilised to implement activities with the focus being the protection of forests, the « reservoir par excellence » for biodiversity and for carbon sequestration in the country. The objective was, in the long term, to put CAR on the path towards a robust market for carbon trading, but this has yet to materialise due to the present carbon market situation. However, RPP still remains very relevant for climate change in the country, especially with respect to mitigation and adaptation measures.

The main expected output from RPP was a net reduction in GHG emissions attributed to forests through capacity development of national institutions. Towards this end, several initiatives were implemented, including a project on community forests and another one on management and participatory restauration of degraded forests in Basse-Lobaye, both funded by the African Development Bank in the amount of $ 165,000. In order to ensure better governance of the REDD process, including REDD+, and implementation of RPP, the Government recently established a Coordination Unit by way of a Presidential Decree dated 9 February 2017.

First (Initial) National Communication to UNFCCC: The First (Initial) National Communication to UNFCCC prepared in December 2002 by the Ministry of Water, Forests, Hunting, Fisheries, Environment and Tourism (short form: Ministry of Environment) indicated that "several adaptation and mitigation strategies for CO_2 emission reduction and carbon sequestration were discussed within the framework of studies on Forestry and Energy". They all pointed

towards the utilisation of renewable energy technologies and reforestation/afforestation for emission reduction and "job creation in both urban and rural areas and this would contribute to reducing rural exodus towards large agglomeration".

Second National Communication to UNFCCC: The Second National Communication submitted in 2013 covered the period 2003 - 2010 and estimated that the total GHG emissions in 2010 (the base year used) were 116 million tonnes of CO_2, representing 0.002% of global emissions or equivalent to 26 tonnes of CO_2 per capita. On the other hand, its absorption capacity during the same base year was 330 million tonnes of CO_2, making the country a net sink. It noted that Land-Use Change and Forestry (LUCF) accounted for 89.5% of the total emissions, followed by agriculture with 5.3% and energy with 5.2% (including 4.9% for wood fuel); the contribution of industrial processes to the total emission was a negligible 0.1% (the numbers have been rounded off). Despite the need for the country to develop its economy, it plans to reduce its per capita emissions to 20 tonnes of CO_2 by 2030 and 12 tonnes of CO_2 by 2050.

Intended Nationally Determined Contribution: Projections made in 2015 during preparation of the Intended Nationally Determined Contribution for submission to UNFCCC point to GHG emissions increasing to 189 million tonnes of CO_2 by 2050 compared to the base year of 2010, representing a net increase of 63% that takes into consideration the projected level of population growth, if no remedial actions were implemented. The sectors contributing to such an increase are: LULUCF -69% increase, energy -13.4% increase (including 10.7% for wood fuel), waste -3.2% increase and industrial processes - 1.6% increase. As per the INDC, the Government plans to reduce emissions by 5% compared to the business as usual reference level (i.e. 5.5 million tonnes of CO_2 of avoided emissions) by 2030 and 25% (i.e. 33 million tonnes of CO_2) by 2050, within the framework of conditional implementation.

1.3 Baseline Situation and Problem to be addressed

- **Rural Electrification in CAR**

The Government is cognisant of the fact that it is an unsurmountable task to serve the un-electrified 94% of the country's rural population through grid extension and/or new power stations due to the massive investments required and the scarcity of budget resources. Consequently, there is a keen awareness among decision makers of the need to develop more decentralised, sustainable and modern forms of energy for the much-dispersed rural areas in terms of lighting, refrigeration, cooking and income-generating activities. Among the priorities of the Government for the electricity sub-sector, there resides a focus for an increase in reliable electricity services through rehabilitation and extension of existing generation capacities, strengthening of the transmission and distribution system, reform of ENERCA for better governance, rural electrification based on renewable energy sources, implementation of energy efficiency measures, interconnection with neighbouring Congo-Kinshasa (an example of interconnection is the 11 MW hydropower station located in Mobayi in Congo-Kinshasa that already supplies electricity to Mobaye in CAR through a 0.9 km long, 6.6 kV line and a 630 kVA transformer) and potential hybridisation of the electricity network, mainly solar and hydro, where feasible.

As discussed earlier, rural electrification in the country is under the responsibility of ACER. Unfortunately, due to the lack of sufficient support from decision makers and the absence of a regular financial resource stream, ACER is yet to implement its first village electrification project, although it has installed, as mentioned above, a few PV street/outdoor space lighting systems under donor-funded programmes. Hence, as a stop-gap measure, this function has continued to be implemented by ENERCA in that it has installed and operated 15 diesel-based mini-grids to supply electricity to Prefectures/Sub-Prefectures, as indicated in Table 6 above, although only one 44 kVA generator is presently in operation in Mongoumba. Hence, the Government then de facto chose the public utility model for rural electrification from among the different options, viz. Public Utilities, Private ownership, NGOs, Community Cooperatives and Mixed (Source: The ACP-EU Energy Facility: Sustainability - Business Models for Rural Electrification, 2012).

However, besides being unable to replace those diesel generators that have been vandalised and taking note of the financial difficulties faced by ENERCA to maintain the remaining generators and/or supplying them with fuel for operation, the Government now considers Public Private Partnerships as an important vehicle in energy project

development to meet the electricity needs of the 61% of the population that live in the rural areas without any access to clean fuels. This view was underscored at the forum for the promotion of the private sector that was held in Bangui in September 2015. In addition, as mentioned earlier, only 8% of the total population of the country's 5.1 million, urban, peri-urban and rural combined, have access to clean fuels. Such a public private partnership may lend itself to a win-win situation on the understanding that, as a start, the private sector would be encouraged to develop power stations, with ENERCA (the public sector) making available its existing and "dormant" distribution systems in the Prefectures/Sub-Prefectures, albeit with some refurbishment and/or extension, to the former to distribute and sell electricity to consumers. Utilisation of the existing distribution lines could be on a straight lease or lease-purchase basis under terms to be negotiated by both parties.

- **Barriers to Rural Electrification**

In light of the above and with regard to rural energy services, the Government proposes to utilise the abundance of hydro resources, where available/appropriate, to meet the energy needs of the rural communities, especially as many of the rivers still have sufficient flow even during the dry season. Also, this is in line with the 3 objectives of the Sustainable Energy for All Initiative, viz. to ensure universal access to modern energy services, double the rate of improvement in energy efficiency and double the share of renewable energy in the global energy mix by 2030. Thus, the transformation of the rural energy sector to an economically viable and environmentally friendly system requires a comprehensive and multi-faceted approach in the design of appropriate policy and institutional frameworks, and incentives to fully integrate small hydropower among other renewable energy technologies into the country's energy mix.

Moreover, the Second National Communication identified the development of renewable energy technologies (hydro power electricity generation, renewable fuelwood through woodlots to reduce deforestation) as one of the mitigation measures "to change the country's economic growth from intensive carbon mode to low carbon mode". This was reinforced by the INDC (Intended Nationally Determined Contribution) formulated for COP-21 (Paris, 2015) that singled out emission reduction to the extent of up to 90% hinging upon the development and utilisation of renewable sources of energy. Towards this goal, INDC proposed the increased use of renewable energy resources, mainly the development of "Hydroelectric micro-dams" in view of the abundant hydropower, as one of the options in a basket of measures to pursue to reverse the increasing trend in GHG emissions in the country.

Finally, the EU TAF document referred to earlier indicates that "There is no on-going programmes or projects that target rural electrification. The Government is presently very much focused on dealing with urban electricity supply, mainly in the capital city, that it has had no opportunity to turn its attention towards rural electrification. Coupled with this is the problem of insufficient technical capacity available within ACER and ARSEC. Moreover, there is no Rural Electrification Policy and, consequently, both a rural electrification strategy and implementation framework are absent. This leads to frustration among the two-thirds as the national population living in the rural areas and, coupled with the absence of economic opportunities and prevailing poverty among the rural inhabitants, feeds into the conflicts that the country has lately experienced".

- **Barriers faced by small hydro power plants**

Small hydro power plant face specific barriers beyond the ones described above. First, the technology is largely unknown in the country. Besides the 120-kW SHP station in Gamboula there are no known installations that can serve as a model for financial viability to project developers and investors. Second, SHP are more expensive to set-up than the diesel mini-grid previously installed by ENERCA. Financial models for this project show for instance that a 600 kW SHP mini-grid would could cost 30% more to install than a diesel mini-grid (see table 9). And finally, the overall situation is exacerbated by the absence of private and public-sector funding for rural electrification.

Domestic commercial banks are not typically involved in the energy sector. Bank managers from ECOBANK and the Commercial Bank Centrafrique met during the PPG phase stated that they do not have either specific products or the expertise to invest in the renewable energy sector. The financial sector in Central African Republic is generally unsophisticated and undeveloped. It is the smallest in the Central African Economic and Monetary Community

(CEMAC). The country has 3 commercial banks[3], 4 large Microfinance Institutions[4] and 2 post office banks[5]. According to a 2009 IMF Financial System Stability Assessment the domestic financial sector in CAR contributes very little to the country's economic growth and is saddled by government borrowing which in turn limits cash availability for the private sector. The IMF assessment further noted that "less than 1 percent of the population has access to banking sector services; the scope for promoting SME lending is constrained by weaknesses in the legal and regulatory framework; the range of financial products offered by banks is not diversified, and credit information is poor." The World Bank 2017 Doing Business report ranks CAR number 185 (out of 190 countries) for access to finance.

Public finance is being channelled into the country since the November 2016 Brussels Forum where the international community pledged over 2 billion Euros to fund the country's National Recovery and Peacebuilding Plan (NRPP). Pillar 3 of the NRPP[6] intends to repair the ageing electricity infrastructure and construct new electricity installations at an estimated cost of 267 million USD. This includes small-scale installations based on renewable energy. However, most of these funds- pledged at the Brussels Forum or otherwise- are expected to be channelled through the national budget or earmarked as grant funding for specific projects and programmes. For instance, the World Bank Emergency Power Response Project is restoring electricity supply from the Boali 1 and Boali 2 hydro power plants; the French Development Agency (AFD) is planning a water infrastructure project in the north-east region of the country. The institutions that are administering CAR's foreign aid -namely The Bekou Trust Fund, the Ezingo Fund and the CAR Humanitarian Fund- are currently not providing public finance directly to the private sector nor extending guarantees to facilitate loans to the private sector. Finally, the World Bank has been formulating an $ 18 million technical assistance proposal to support electricity and water supply in selected cities like Bangui, Bria and N'Délé, but this assistance will not focus on the load centres that are the target of this project.

Nonetheless, one notable effort that is underway is the establishment of a National Guarantee and Investment Fund (FNGI in its French acronym) with the mission to support small and medium enterprises in all major sectors of the economy, including energy. According to the Ministry of National Entrepreneurship, Handicraft and the Promotion of Small and Medium Enterprises, the Fund is scheduled to be operational by early 2018. To date, it has mobilized 50 million USD from the African Development Bank out of its goal 80 million USD[7]. The Fund's rules and by-laws are not in place yet but the feasibility study conducted for the Fund recommends a 60% to 70% guarantee for loans above 80,000 USD that have repayment period of 5 years. It is not clear yet if there will be a cap on the loan amounts that the Fund can guarantee but already the 5-year repayment period is cause for concern since debt finance in the SHP will likely need a minimum of 10-year repayment period. As part of this project, the UNDP country office in CAR is engaging with the Ministry to ensure that the Fund takes into account the financial conditions of investments in SHP.

In addition to the FNGI, Central African Republic is one of the 14 members of FAGACE, an African guarantee fund that supports private and public-sector investment in agriculture, industry, energy, health, etc. FAGACE guarantees loans of 80,000 USD and up for 60% of the total loan amount. Recently, FAGACE has provided a guarantee for 5 million USD to Telecel Centrafrique, a cell phone operator in CAR[8].

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[3] Commercial Bank Centrafrique; Banque Populaire Maroco-Centraficaine ; Ecobank and Banque Sahelo-Saharienne pour l'industrie et le commerce.

[4] Crédit Mutuel de Centrafrique, Union Centrafricaine des Caisses d'Epargne et de Credit, Societe Finance Africaine de Credit and Express Union

[5] Making Finance Work for Africa https://www.mfw4a.org/central-african-republic/financial-sector-profile.html (accessed March 7, 2017)

[6] Central African Republic (nd), "National Recovery and Peacebuilding plan 2017-21"

[7] Ngawen, J. (January 2017) "Etude de faisabilité du Fonds National de Guarantie et d'Investissement"

[8] http://le-fagace.org/fr/content/plus-de-11-milliards-du-fagace-pour-appuyer-cinq-soci%C3%A9t%C3%A9s-africaines

As indicated earlier, there is very little experience in the country with small hydropower stations operating in an isolated mini-grid configuration for rural electrification in the country. Almost all the existing ENERCA diesel-based mini-grids have not been operating for several years now due to the unavailability of fuel and or spare parts for maintenance and repairs. Therefore, the present project will provide a start to utilising small hydropower-based mini-grids to provide modern energy services to the rural areas, given the very promising potential that hydropower technology has to reduce GHG emissions and improve livelihoods of the population, especially of those living in the rural areas. A novel approach will be applied through enabling the private sector to drive the initiative to develop these small hydropower-based mini-grids in the country; the crucial role of the Government will be to create the appropriate environment for this private sector-driven modality to successfully move forward.

In line with the foregoing, GEF intervention is needed to remove the policy, regulatory and market barriers which hamper realisation of the Government plans to harness the abundant small hydropower potential in the country.

A summary of the barriers to rural electrification in CAR and the strategy for addressing them are presented in Table 7 below.

Table 7: Summary of barriers and mitigation strategies

Barrier	Present Situation	Strategy for addressing barrier
Policy/Regulatory	Absence of a conducive policy and regulatory framework that facilitate investor interest in small hydropower-based electricity generation for isolated mini-grids.	A set of regulations will be developed to facilitate private sector investment in small hydropower-based electricity generation for isolated mini-grids.
Financial	Absence of public funding to support private sector engagement in rural electrification Limited knowledge of SHP from commercial banks Limited engagement of commercial bank in private sector High cost of capital Absence of financial incentives for private sector involvement in rural electrification Absence of financial incentives to facilitate the uptake of small hydropower to supply isolated mini-grids.	The project will link-up with the soon-to-be-established National Guarantee and Investment Fund to provide loan guarantees to SHP developers and therefore unlock lending from commercial banks and reduce cost of capital. The project will build the capacity of local banks to better appraise investments in SHP and create appropriate financial products A financial instrument will be put in place to support the development of 4 SHP by private developers.
Technical	Insufficient capacities at the local level to deliver turnkey solutions and quality O&M&M services for SHP development.	Local institutions and project developers will be supported to provide quality O&M&M services for SHP development.

Economical	Absence of viable options for expanding income-generating activities in rural communities through utilising electricity services.	Viable income generating activities through electricity utilisation will be implemented.
Promotion/ Outreach	Absence of promotional/outreach activities and lack of project experience/best practices.	Outreach/promotional activities will be implemented and project experience/lessons learned will be documented.

III. STRATEGY

Project Rationale and Policy Conformity

The project's goal is to reduce GHG emissions by creating a favourable legal, regulatory and market environment and building institutional, administrative and technical capacities to promote rural electrification through isolated small hydropower-based mini-grids. Currently, there is no autonomous electricity generation in the country that supplies isolated mini grids outside those that were built by ENERCA. Even most of ENERCA's 15 diesel-operated mini-grids built to supply the Prefectures/Sub-Prefectures are not operational due to lack of maintenance and spare parts and, often, the unavailability of fuel. There are, however, a few self-generators who produce electricity for their own consumption, either through SHS or small diesel generator sets; these are consumers who either live far from the existing grid or are small entrepreneurs (bakeries, hotels, restaurants, etc.) who are determined "to ride out" the frequent black-outs that negatively impact upon their businesses.

The objective is to assist the Government of the Central African Republic, as outlined in the recently formulated draft "Decentralised Energy Policy" (DEP), in its overall objective "to guarantee access to efficient, sustainable and modern energy services to the rural population by 2030 and at an affordable cost" and in a sustainable manner, with minimal negative impact on the environment. The DEP, when approved, will enable the Government to integrate energy into national and sectoral planning and that will serve as a catalyst for effective energy utilisation to improve the livelihoods of the people of CAR as well as to drive economic growth.

Under a business as usual scenario, implementation of rural electrification for the majority of the population with reliance solely on Government budgetary resources and without the participation of the private sector, will take a very long time to materialise. Hence, the project will support the Government of CAR, working with the private sector, to use the Public Private Partnership approach in hydropower-based electricity generation, thus enabling the rural population to enjoy a better quality of life and to embark upon income-generating activities utilising electricity services. This is proposed to be achieved through the following:

- Streamlining and simplifying policy, regulatory, legislative and financial instruments for SHP-based isolated mini-grids for rural electrification;
- Developing capacity of stakeholders for SHP-based isolated mini-grids development and management for rural electrification;
- Creating attractive and competitive business terms and conditions for investors, such as providing financial incentives towards project development and implementation, which will give developers long-term stability and provide for sufficient investment return; and
- Facilitating implementation of SHP-based isolated mini-grids for rural electrification in the country through a pool of trained technicians who would ensure high quality construction, operation and maintenance of the systems and ancillary equipment.

Institutional Structure

As indicated earlier, the Directorate General for Energy is directly responsible for implementing the Government's energy policy and accomplishes this through its several Directorates, including the Directorate for New and Renewable sources of Energy for activities related to the promotion of Hydropower, Bioenergy, Geothermal Energy, Solar and Wind Energy. In this capacity, it will be entrusted with implementation of the present project under the UNDP Direct Implementation Modality (DIM) and, in doing so, it will work very closely with other Government Agencies, the private sector and NGOs to ensure that the participation of the full range of stakeholders is secured and effective.

Financial Support to Project Developers

The project will support the roll-out of 4 SHP mini-grids totalling over 2 MW installed capacity. The installations proposed will provide electricity to the towns of Bambari, Mbaiki, Boda and Gamboula. The business-as-usual practice has been to provide electricity to these areas with small diesel power stations. Up to 2012, Bambari, Mbaiki and Boda had diesel mini-grid systems operated by ENERCA. These installations are no longer functioning. Gamboula has an existing mini hydro station that the project is proposing to expand to provide electricity to a nearby town.

The town of Mbaiki for instance, has an estimated total electricity demand of 9,360 kWh/day for about 3,500 households, 56 non-household consumers (administrative buildings, schools, hospital, shops, etc.) and about 100 public lights. The town was formerly electrified by a 125KVA diesel power station that produced 2,529 kWh in 2008 and connected 53 customers.

If the same level of service was to be provided as proposed by the project with a new diesel power station, the initial capital investment would be significantly less than that of the SHP. First, construction cost would be lower: whereas the cost of diesel plant is estimated at $1,500 per kW installed, it is $4,500 per kW installed for SHP[9]. Second, the 10-km transmission line that has to connect the hydro plant to the town would be avoided with a diesel plant. Third, expenses for pre-project studies would be negligible since studies from the previous diesel plant could be used. Nonetheless, over a 25-year period the diesel plant is costlier than the SHP because of high maintenance, fuel expenses and the replacement of diesel generator every 10 years. Already, at the onset of the project, the diesel power plant would need over 1.4 million USD in working capital to cover for the first two years of operation. These funds would have to be secured from a financial institution at the going interest rate thus raising the cost of capital. In contrast, the SHP would only need $154,000 in working capital for the same period.

Table 8 below summarizes the upfront capital investment for the site of Mbaiki with the diesel option and the SHP option. Clearly the high price tag of SHP is a major deterrent to investment in this option for a cash-strapped government looking for a quick solution or a private investor eager to get a rapid return on investment. This is undoubtedly the reason why ENERCA installed a diesel power station in Mbaiki when it undertook the electrification of this town.

Table 8: Capital investment comparison

Mbaiki upfront capital investment		
	Hydro	**Diesel**
Plant installation cost	$2,700,000.00	$900,000.00
Transmission line	$474,926.10	---
Customer connections	$721,000.00	$721,000.00
Pre-project studies	$296,721.31	$30,000.00
Working Capital	$154,391.54	$1,431,965.84
Permits and licenses	$40,000.00	$40,000.00
Total	$4,387,038.96	$3,122,965.84

Table 9 shows the financial viability of the SHP versus the diesel plant over a 25-year period. The amount of financing required includes working capital for the first two years of operation. For the diesel plant, the generator is replaced every

[9] ENERCA estimates

10 years. Over a 25-year period, the LCOE of the SHP is $0.13/kWh whereas that of the diesel power station is $0.83/kWh. The owner's equity IRR is 15% for the SHP and negative for the diesel plant.

Table 9: LCOE and IRR comparison

Mbaiki		
	Hydro	**Diesel**
Model period (years)	25	25
installed capacity (kW)	600	600
Capacity factor	0.8	0.52
Average annual electricity sale (kWh/year)	3,611,852	2,733,120
Investment required ($)	$4,387,038.96	$3,122,965.84
Owner contribution	$877,407.79	$624,593.17
Financing required	$3,509,631.16	$2,498,372.68
Cost of capital	15%	15%
LCOE ($/kWh)	$0.13	$0.83
Owner's Equity IRR	14.6%	Negative
Project IRR	14.8%	Negative

As demonstrated above, SHP are financially viable in the long term but their high upfront capital investment is intimidating. For project developers, the first challenge is to mobilize funds for feasibility studies, markets studies and environmental assessments (pre-project studies) which are all pre-requisites for approaching investors but are typically not financed by commercial banks. The second challenge is to raise the 20% co-financing required by most banks. The third, and perhaps most difficult challenge, is accessing finance for the remaining 80% capital investment.

The project will provide incentives to project developers in the form of a financial support for the procurement pre-project studies and the procurement of equipment or construction. The financial instrument will address the first two challenges by contributing $200,000 to each site for the procurement of pre-project studies and $125,000 for the procurement of SHP equipment or construction. Payment will be made to consulting firms selected to undertake the studies and to the vendors providing the equipment. This financial support will reduce the project developer's co-financing by $325,000 and make him/her ready for investment.

With regards to the third challenge, the project will link up with the African Fund for Guarantees and Economic Cooperation (FAGACE[10]) and the soon-to-be-created National Fund for Guarantees and Investment (FNGI[11]) to facilitate SHP developers' access to finance. In addition to unlocking funds from local banks, these guarantees can decrease the interest rate on the loan to project developers which would significantly lower their cost of capital and would result in lower electricity prices for consumers.

The total investment required for the 4 sites is estimated at 15.5 million USD of which 3.1 million USD (20%) is expected to come from private developers as equity and 12.4 million USD from financial institutions as debt financing. The

[10] French acronym of "Fonds Africain de Garantie et de Coopération Economique"

[11] French acronym of "Fonds National de Garantie et d'Investissement"

financial support provided by the project will contribute 1.3 million USD into the developers' co-financing thus decreasing their share to 1.8 million USD.

Table 10: Investment for 4 SHP sites

	Mbaiki	**Bambari**	**Boda**	**Gamboula**	**Total**
Total Capital Investment	$4,387,038.96	$5,251,116.79	$3,426,412.42	$2,513,281.71	**$15,577,849.87**
Project developer co-financing (Equity)	$877,407.79	$1,050,223.36	$685,282.48	$502,656.34	**$3,115,569.97**
Financial support	$325,000.00	$325,000.00	$325,000.00	$325,000.00	**$1,300,000.00**
Project developer co-financing after project's financial support	$552,407.79	$725,223.36	$360,282.48	$177,656.34	**$1,815,569.97**
Debt	$3,509,631.16	$4,200,893.43	$2,741,129.94	$2,010,625.36	**$12,462,279.89**

Table 11: Financial instrument break-down

Total amount	$1,300,000.00
Financial support for pre-project studies	$800,000.00
Financial support for construction and equipment	$500,000.00

The financial support for pre-project studies will be up to $200,000 and can be used primarily for feasibility studies, technical studies, environmental assessment studies or any other activities that are pre-requisites for submitting a loan application to a financial institution. The funds can only be paid out to consulting firms selected to undertake the studies and can only cover up to 60% of the total cost of any of these activities. The project developer must present proof that the remaining 40% is mobilized before funds can be approved. Further, disbursement will occur in tranches based on milestones achieved in the implementation of the said activity. For instance, if the activity is a feasibility study that costs $120,000, financial support can be approved for $72,000. 40% of the $72,000 can be disbursed upon presentation of the service contract between the project developer and the firm executing the study; 30% at submission of draft feasibility report to UNDP and 30% at submission of final feasibility report to UNDP.

If the full $200,000 is not used in one activity, the balance can be applied to another activity for the same site. In the previous example, the remaining $128,000 could be used for environmental impact assessment for instance. The modalities of approval and disbursement would be the same i.e, no more than 60% of the total cost and disbursement in 3 tranches.

Table 10: Summary of financial terms for financial support to pre-project studies

	Financial support to pre-project studies
Total amount per site	$200,000
Share of total cost covered by financial support	60%
Maximum amount to covered by financial support	$100,000 per activity
Fund recipient	Consulting firm undertaking the studies
Disbursement tranches	3 per activity
Disbursement frequency	As needed
Duration of financial support	5 years

The financial support for equipment/construction comes into play only when the SHP is approaching construction phase. While the project developer applies for loans, he/she can be provided with certified document proving that funds are available to him but in no case, will the fund be disbursed without proof that the rest of the financing is approved. The financial support can only cover up to 60% of the equipment or construction to which it is being applied. If the funds are for equipment, the cost estimate for the equipment to be purchased must supplied directly to UNDP by the supplier. Funds must be disbursed directly to supplier. If the financial support is for construction, a full cost estimate signed by the service provider must also be provided to UNDP. In both cases, the funds will be disbursed in two tranches: 50% when the equipment is ordered or at start of construction and 50% when the equipment is received or construction is completed.

Table 11: Summary of financial terms for equipment/construction financial support

	Financial support for equipment/construction
Total amount per site	$125,000
Share of total cost covered by financial support	60%
Maximum amount to be covered by financial support	$125,000 per activity
Fund recipient	Supplier/Service provider
Disbursement tranches	2 per activity
Disbursement amount (per disbursement)	$62,500
Disbursement frequency	As needed
Duration of financial support	5 years

Country ownership: country eligibility and country drivenness

Rural electrification through isolated, renewable energy-based mini-grids, which has not been the focus of much attention to date, is one of the important mitigations options that the Government of the Central African Republic wishes to pursue for reducing greenhouse gas emissions in the country. In this connection, projections made in 2015 during preparation of the Intended Nationally Determined Contribution (INDC) for submission to UNFCCC point to GHG

emissions increasing to 189 million tonnes of CO_2 by 2050 compared to the base year of 2010, representing a net increase of 63% that takes into consideration the projected level of population growth, if no remedial action were implemented.

Also, the draft Decentralised Energy Policy points towards the country's need to, among others, contribute to the improvement of livelihoods through the creation of income generating opportunities that sustain and improve the lives of people in the country through facilitating the provision of affordable technologies and services and to utilise clean energy resources.

Thus, the project is in line with national priorities and will contribute to meeting the objectives of the Government to reduce GHG emissions that contribute to global warming and to promote energy development that will cater to the needs of the population.

Design principles and strategic considerations

The project will promote a market-driven approach to encourage the participation of the private sector to generate electricity in the rural areas through the development of small hydropower stations. In line with GEF requirements, "the emphasis will be upon developing policies and regulatory frameworks that provide limited incremental support to strategically important investments", such as investment in electricity generation from hydropower, allowing the country to move towards energy independence and increased energy security in an environmentally and climate-friendly way.

As the law presently stands, following the Government's decision to reform the electricity sector and establish an Electricity Code in 2005, the private sector (IPP) is allowed to generate electricity in the country either for sale to the ENERCA network or to operate an isolated mini-grid. However, the accompanying guidelines and procedures for private sector participation in the electricity sub-sector, including tariffs to be paid by consumers connected to isolated mini-grids, have yet to be formulated or approved. As a result, no IPP has to date participated in the uptake of the private sector-driven electricity market. However, the draft Decentralised Energy Policy presently being discussed will remedy this situation by defining the accompanying guidelines and procedures that will follow through on the Government's commitment to involve private sector participation in delivering modernised energy services to the large number of unserved households in the rural areas. Accordingly, the project will assist the Government to realise the objectives of the 2010 National Energy Policy to provide an "increase in the electricity access level" to the population and to design and adopt regulations aimed at promoting private-sector driven rural electrification through the utilisation of hydropower for electricity services "to all enterprises and households throughout the country on a competitive basis".

IV. RESULTS AND PARTNERSHIPS

Project objective, outcomes and outputs/activities

The objective of the project is to contribute towards the reduction in the growth of GHG emissions through promoting the implementation of hydropower in a mini-grid configuration to meet the need for electricity services of the rural population. It proposes to put in place an enabling environment for the development of small hydropower stations and develop and showcase a suitable business model and financial instruments for their viability, sustainability and replication. This objective is proposed to be achieved through the participation of the private sector working hand in hand with village community organisations. Thus, this programme will not only benefit rural households and small commercial enterprises, but will also connect the private sector, financial and technical training institutions, and local organisations to promote the establishment of distribution channels to develop the small hydropower market for the provision of electricity services. Towards this end, the Government is planning to establish a Rural Electrification Fund (REF) that will support rural electrification, fund studies to promote the development of renewable energy, in partnership with ACER and ARSEC, and to possibly co-finance investment. It is envisaged that funding for the REF will initially come from donor grants and would be replenished from a levy on the sale of electricity in the cities and on certain goods and services.

The project consists of four components as outlined below. It is recognised that on-the-job training will be provided by the recruited consultants, both local and international, during the normal course of their support to the relevant project activities and a communication strategy formulated to inform stakeholders on project implementation. Moreover, the project will seek to achieve gender equality through the empowerment of women (e.g. working with women's association such as the National Rural Women Organisation (Organisation Nationale des Femmes Rurales) and the equal participation of men and women (e.g. such as the National Rural Women Organisation (Organisation des Femmes Rurales, Femmes-Forets-Developpement, Fleurs de Centreafrique) in all project activities and specifically those related to capacity development under the various components. In addition, the project will solicit the participation of NGOs working in the field of sustainable energy at the community level (e.g. ERADD – Energie Renouvelable et Action pour le Développement Durable, Groupe d'Etude et d'Action pour le Centrafrique and Association of Electricity Consumers), capacity development institutions like Lycée Technique de Bangui, Institut Moderne des Métiers Spécialisés, Institut Supérieur de Technologie, etc.

Further, the project will provide incentives to project developers in the form of a financial support for pre-project studies and equipment or construction. In addition, it will establish linkages with existing loan guarantee facilities that will unlock investment capital in the sector and decrease the cost of capital for project developers thus enabling them to provide electricity at an affordable rate.

Component 1: Policy and financial instruments and incentive scheme for small hydropower (SHP) based mini-grids.

This component will jumpstart the participation of the private sector in the development of small hydropower-based mini-grids for rural electrification in the country. At the present time, electrification outside of Bangui, the capital, is almost non-existent (almost all ENERCA-managed diesel-based mini-grids in the Prefectures/Sub-Prefectures are not operating), except for some enterprising NGOs and private individuals who have installed their own renewable energy or fossil fuel-based generators that provide them with electricity for a few hours a day. Hence, to bring the private sector into this equation to generate electricity to supply the rural areas requires a business model that combines the existing public sector-based model of ENERCA (or an NGO-based model, where appropriate) with the profit-driven model of the private sector and, consequently, generate a sustainable and win-win partnership that would be beneficial to both the Government/community and the private sector. This could take the form of, for example, the Government/community

participating in partially owning the assets (e.g. an existing un-operational ENERCA distribution system, where available), while entrusting the private sector with electricity generation from small hydropower resources and providing electricity services to rural consumers through its overall daily operation, maintenance and management of the complete "electricity generation-to-transmission/distribution-to sale" process. In those circumstances where no electricity distribution systems exist at the load centres, the private sector will endeavour to solicit village community participation in their construction and operation. Such a modality has the potential of reducing operational costs that, eventually, will get passed on to consumers/villagers in the form of tariffs that they are charged.

The policy and financial instruments to be developed in this project will be tailored to mini-grids around SHPs, e.g. reduction of upfront investment costs, financially viable tariffs, subsidies, concession regimes, licensing rules, and public private partnerships (PPPs). Policy instruments will also include putting in place a tripartite agreement between the Government (Ministry of Mines, Energy and Hydraulics/ARSEC/ACER) and private investors/developers. The policy instruments will be specific to mini-grids built around SHPs, but can be expanded in the future to include them in a hybrid configuration, if warranted by the type of renewal resource availability and load configuration.

Outcome 1: Institutional and financial viability of SHP mini-grid ensured. The expected outputs under this component are:

Output 1.1: Policy package to develop and operate SHP-based mini-grids adopted.

- Streamlined policy and legal/regulatory framework established and operational for private sector electricity generation to supply isolated mini-grids through small hydro power stations. The project will review the Government's "Electricity Code" of 2005 and the proposed "Decentralised Energy Policy" to determine the issues that act as barriers to the private sector playing a role in decentralised electricity generation from small hydropower in the country. Following this, the project will develop a policy document outlining the remedial measures that are necessary, including the procedures/regulations accompanying the Electricity Code, and propose a legal/regulatory framework that will promote private sector investment in small hydropower development. The project will then seek the Government's approval to operationalise this whole set of documents. Special attention will be devoted to having all accompanying procedures/regulations (textes d'application, in French) promptly in place in order to ensure that the policy and legal/regulatory framework does not suffer from delays in being applied.

Output 1.2: Financial instrument to support SHP mini-grid development, adopted and implemented.

- Financial instrument established to support private investment in 4 SHP-based mini-grids for rural electrification. This include providing support for pre-project studies, equipment and construction. In addition the project will partner with loan guarantee funds and commercial banks to facilitate project developers' access to finance, provide guidance during business plan formulation and loan application and identify other funding sources for the project developers.

  Additional incentives will be introduced in the policy package (output 1.1) such as reduction/elimination of import duties/taxes on equipment and spare parts, income tax holiday for a specific duration, simplification of foreign exchange regulations and simplification of EIA procedures for mini/small hydropower. All these will be operationalised by UNDP under the DIM modality, in consultation with MMEH and other Government Departments.

Output 1.3: Tariff criteria for SHP- based mini grids defined.

- Standard environmental/technical methodology for evaluating hydropower projects and financial evaluation methodology for calculating small hydropower tariffs to be charged to consumers. Criteria and guidelines will

be formulated, in consultation with ACER and ARSEC, for technical evaluation of projects and an excel programme will be developed to undertake economic and financial analyses, and to determine tariffs that project developers can reasonably charge to rural consumers, taking into consideration the capacity of the latter to pay for these electricity services.

Output 1.4: Dedicated window at national clearinghouse (one-stop shop) for SHP developers established.

- Strengthening the existing one-stop shop (established as per the Investment Charter under the supervision of the Ministry of Commerce and Industry) by setting up a dedicated window for issuance of construction licenses and permits to small hydro project developers. At the present time, the one-stop-shop is not staffed/equipped to perform this function. The dedicated window at the one-stop-shop will be the custodian of all information that a potential developer will need prior to making an application, all applications forms and the required documentation needed to be submitted in support of an application, any fees to be paid, advise developers if any additional documentation is required and provide a final decision on the outcome of an application. This will obviate the need for the developer to personally visit several Government offices for necessary clearances and speed up the approval process for an SHP development permit.

Component 2: Capacity Development for SHP based mini-grid system operation, maintenance and management.

This component will address the technical barriers to the implementation of hydropower-based isolated mini-grids for rural electrification. The objective is to assist the communities, ARSEC, ACER and the potential service developers to upgrade their capacity for delivering turnkey solutions. Technical assistance will be provided to a number of competitively selected local men and women private sector developers who may be interested in the development, operation and management of small hydropower-based mini-grids for rural electrification. The private sector developers may associate themselves, if they so wish, with international partners to benefit from the latter's experience and exposure in similar markets outside the Central African Republic and, more specifically, in the Democratic Republic of Congo (Congo-Kinshasa) and the Republic of Congo (Congo-Brazzaville) where the UNDP is implementing similar projects dealing with small hydropower-based mini-grids for rural electrification.

In addition, the project will provide capacity development to system designers, builders/installers and end-users, develop and publish a manual on design, installation and maintenance of small hydropower systems, taking into consideration any potentially adverse impacts that small hydropower development may have on land use, water rights, bio-diversity and safe utilisation of electricity services. Confidence and capacity building of private sector investors will be conducted. Also, community organizations in the targeted villages (women groups, local NGOs and SMEs/productive users) will be provided with assistance and advice on utilising electricity both for personal use and income-generating activities. Key stakeholders in the governments, involved civil servants and selected national agencies will also benefit from the capacity development modules.

The implementation of SHP mini-grids is a technical field that is generally male-dominated but at the same time CAR is lacking a critical mass of SHP engineers, system designers, installers and maintenance technicians. As such, the capacity development will offer both men and women an equal chance to enter the sector by tailoring some of the training to young high school graduates and college students and by specifically encouraging young women to participate.

Outcome 2: Capacity to deliver turnkey solutions and quality operation, maintenance and management (O&M&M) services for SHP developed. The expected outputs are:

Output 2.1: Published Guidebook on SHP-based mini-grid development.

- Published Guidebook on development of SHP-based mini grids. This Guidebook will provide a detailed step-by-step approach for implementing SHP mini-grids and will serve as a tool for the benefit of system designers,

installers and operators to enable them to properly design, build, operate and manage small hydropower stations and assist all stakeholders to enhance their common understanding and commitment about SHPs. It will also aim at facilitating discussions between Prefecture/Sub-Prefecture community groups and the private sector and serve to demonstrate how SHP mini-grids can be a vehicle to foster economic and social growth, through the achievement of development imperatives, while minimizing negative social, cultural and environmental impacts in the villages. Finally, it will contain model applications forms and will provide information/guidelines on the required documentation for the issuance of construction licenses and permits to potential developers, together with any associated fees.

Output 2.2: On-the-job capacity development programme for SHP (men and women) plant developers delivered, including on plant design, construction, equipment assembly and O&M&M.

- The project will develop capacity of the private sector to strengthen their knowledge and understanding on the various aspects of hydropower development for electricity generation and distribution/sale to consumers, including identification of potential sites, pre-feasibility assessment and preparation of feasibility studies/business plans that will necessarily include plant design, equipment selection and assembly, construction, operation and maintenance. Training modules will be designed and implemented for key beneficiaries (men and women developers, component producers, system designers/installers, service technicians and consumers) and capacity development provided to them in support of general business skills development and technical/managerial project implementation. In this connection, capacity development activities will include issues related to any potentially adverse impacts that small hydropower development may have on land use, water rights, bio-diversity, etc.

Output 2.3: Business and technical advisory services to mini-grid plant developers (men and women).

- A "Help Desk" will be established to provide business and technical advisory services to potential SHP mini-grid developers. This "Help Desk" will be housed within ARSEC and will be staffed with trained personnel to provide quick and targeted responses to requests for assistance and/or guidance to developers on specific issues related to the core aspects of project development, including the preparation of feasibility/business plans and interpretation of tripartite contracts/agreements involving them as developers, ACER and ENERCA. It will also undertake reviews of individual projects prepared by developers for their technical and financial soundness prior to their submission to lending institutions. The support to be provided by the Help Desk will be fee-based; this will ensure its financial sustainability beyond the project period.

Output 2.4: Tailored capacity development programme delivered to relevant national agencies.

- Capacity developed within the Ministry of Mines, Energy and Hydraulics, ARSEC, ACER, local banks and key national stakeholders such as the Ministry of Agriculture and Rural Development and Ministry of Interior on best practices and opportunities for decentralized village electrification models in off-grid areas. This will include capacity development to familiarise them with system sizing and optimisation tools (e.g. HOMER and RETSCREEN models) for evaluating system design options, including how to utilise established criteria and guidelines to technically appraise projects, to determine the amount of subsidy to be provided to project developers and to decide on the appropriate tariff that a given developer can charge consumers.
  Capacity of local banks will also be developed to enable them to follow the guidelines to appraise small-hydropower projects for lending. Finally, community organizations in selected locations (women groups, local NGOs and SMEs/productive users) will be provided with training, assistance and advice on potential income-generating activities and relevant safety aspects related to the use of electricity.

Component 3: SHP-based mini-grids roll-out.

The expected outcome of this component is the improved confidence of the rural electrification agency (ACER), the regulator (ARSEC), commercial banks, potential investors/developers and communities in the technical and economic viability of small hydropower-based mini-grid for rural electrification. This will be achieved through putting in place a suitable business model that provides confidence and allows for sustainability and replication. It is expected that successful showcasing in the electrified villages will act as a precursor to implementing similar hydropower-based mini-grids to tap the country's hydro resources for rural electrification. During implementation of the PPG, discussions were held with the Commercial Bank Centrafrique « CBCA » SA and ECOBANK Centrafrique SA regarding their interest in providing debt financing to potential promoters interesting in expanding their business activities to cover small hydropower development in the rural areas. Both banks expressed their interest in working with promoters to prepare business plans that would meet their criteria for evaluation prior to lending.

Through the implementation of this showcase investment project, the appropriateness of the proposed policy and financing instruments will be demonstrated. Construction of the hydropower stations will provide a testing ground for developing a domestic technology supply chain. Furthermore, these power stations are expected to generate valuable information on the suitability and practical implementation of the operation, maintenance and management (O&M&M) models that will be developed. The project will seek to test alternative models, in addition to the public private sector model, like, for example a mixed private-NGO model that could be a possibility at Gamboula where Swedish missionaries operate a 120-kW hydropower station. At the present time, the Gamboula hydropower station supplies electricity only to the hospital, seminary and staff residences; however, increase in capacity by an additional 300 kW will enable electricity to be supplied to the Sub-Prefecture of Mambéré Kadeï consisting of over 2,500 households.

Outcome 3: A functioning business model is demonstrated for the technical and financial viability of small hydro-based plants. The expected outputs are:

Output 3.1: Eight sites for mini-grids identified and assessed, and institutional/investment model defined.

- Table 6 above provides a list of 20 potential project sites identified by the Ministry of Mines, Energy and Hydraulics for hydropower development. These sites constitute a preliminary list that may be subject to change on the basis of additional information submitted by the short-listed investors during project implementation. Feasibility studies were undertaken for 5 of these sites in 1993, but there has been no follow-up since then; should these sites be eventually selected for hydropower development by the private sector, the feasibility studies will need to be updated. In addition, at least another 3 sites will be selected for prefeasibility studies, the objective of which being a preliminary assessment, not yet at the engineering level, to ascertain whether the potential project makes basic techno-economic sense for development in the future. They entail ascertaining the availability of the hydropower resources throughout the year at these sites, the need for any further evaluation of the resource potential, the potential for their development to supply rural areas, the location of sites/villages for the mini-grid, study of infrastructures and socio-economic factors in the village, etc. The pre-feasibility studies will provide all the information necessary to enable the project to determine which of the hydropower sites present the best options for the future establishment of isolated mini-grids.

Output 3.2: At least 4 public private partnerships are established for the exploitation of SHP plants and mini-grids.

- Documents confirming financial closure with the public sector and private investors for at least 4 small hydropower sites[12]. Following a transparent and competitive process, hydropower sites/concessions will be awarded to potential developers under a concessional agreement for a period of 25 years and will include a

[12] At the moment, the sites of Mbaiki, Bambari, Boda and Gamboula are being proposed by the project but other sites with similar characteristics may be considered by project developers.

renewable clause. The feasibility study, construction and operation of the power stations will be solely the responsibility of the developers for supply of electricity to rural consumers either through an existing ENERCA distribution system or, in its absence, one to be built by the private developers. The agreement will also specify procedures to be followed in case the concession for operation is not renewed after the initial 25-year period and at the end of any renewal term.

The solicitation will indicate that the project will provide financial incentives to investors/developers and those bidders with solid proposals and requiring the least subsidy will be selected for the next step in the process, viz. preparing the full feasibility studies and business plans.

The feasibility study will include technical (technical characteristics, load distances, market analysis), economic (economic parameters and project economics), financial (cash flow, internal rate of return/return on investment) and environmental (environmental impact assessment) considerations. Following this, the project will undertake an evaluation of the proposals received to select the successful bidders. Then, the next step will be the actual finalisation and signature of the partnership agreements.

Output 3.3: 2 MW of SHP-based power generation capacity.

- Installed capacity of a minimum of 2 MW (in the present case, the proposed installed capacity will be 2.05 MW) of isolated-grid generation from small-hydro IPPs commissioned at various sites by end of project.

During implementation of activities related to this Component, the project will sensitise and train national and Prefecture/Sub-Prefecture-level energy officials on best practices and opportunities for decentralized rural electrification models through mini-grids. It will also work with the Government's Standards Bureau to ensure that only quality products/equipment associated with hydropower development that meet approved standards are allowed for importation and installation in the country.

Finally, during the course of implementation, the project will monitor new developments in small hydropower generation that could find application within the CAR context when they become commercially available. One example is related to two companies in Ireland, DesignPro Ltd. and GKinetic Energy Ltd., that are collaborating to develop a new range of run-of-the-river hydrokinetic turbines. The hydrokinetic turbine concept involves two vertical-axis turbines placed on either side of a buoyant vessel anchored in a river and the shape of vessel is designed to increase the speed of water flowing into the turbines. Two prototypes, one each of 25 kW and 60 kW, have been built and tested, while funding has been secured to develop a 100-kW prototype for commercialisation. GKinetic believes that device is scalable up to 1 MW and can be deployed in arrays in rivers, oceans or estuaries (Ref. Renewable Energy World, March 2017). This new concept has the potential of considerably reducing the costs of small hydropower generation to supply isolated mini-grids.

Identification of Target Small Hydropower Sites

The sites to be selected for small hydropower development will need to meet on, the one hand, the conditions of being attractive to the private sector for investment by providing an electricity market that is close enough to the hydropower site so as to avoid the construction of expensive transmission/distribution lines and large enough to make the business model viable and, on the other hand, assist the potential consumers with choices/options for modern energy services. The objective is to create a win-win situation for consumers to enjoy the benefits of modern energy services for the improvement of their quality of life and for income-generating activities, while, simultaneously, allowing investors to make sound business investments that will ensure the sustainability of operations. In response to these considerations, a careful and thorough evaluation of potential combinations of sites/villages was undertaken during the PPG phase in order to deliver both social and economic benefits to potential consumers, as well as to boost investment by the private sector.

Two other considerations facilitated the selection of the sites and rural areas to be electrified:

- The PIF indicates that the proposed business model for project implementation "will be a combination of the utility and private sector model. This will be done mainly through public private partnerships. For example, the

utility can invest in the mini-grids installations, while a local private company is responsible for the overall daily operation, maintenance and management".

- The PIF also indicates that "Priority will be given to sites where already exist a mini-grid running with either fossil fuel or other sources, to reduce the high upfront investment cost".

In addition, the recently published TAF referred to earlier indicates that "The global objective pursued by the Government is to significantly increase access to reliable electricity services to urban, peri-urban and rural populations at an affordable cost and to stimulate economic growth through promoting public-private sector partnerships".

The entry point for the public private partnerships is that all but one of the 15 Prefectures/Sub-Prefectures have diesel generators that are not operational, except for one, due to either vandalism or lack of maintenance and spare parts and, often, the unavailability of fuel. However, in almost all cases, the distribution systems are still in place, although some would require rehabilitation and/or extension and strengthening. This presents a conducive situation for the private sector to develop the hydropower site for electricity generation and utilise the existing distribution system, under some lease or other arrangement with ENERCA, to supply electricity services to consumers.

Appropriate sites for small hydro mini-grid implementation were identified through direct consultation with key institutions - Government (Directorate of Energy, ACER, ARSEC, ENERCA and the Ministry of the Interior responsible for Local Government throughout the country) and, in particular, the Heads of Prefectures/Sub-Prefectures, Private Sector, Non-Governmental Organizations, and potential consumers. The selection criteria in Table 8 below were developed, discussed with the stakeholders and utilised during discussions with Prefectures/Sub-Prefectures Heads and other local representatives. The final selection of hydropower sites and Prefectures/Sub-Prefectures to be supplied with electricity will have to be approved by the Project Board.

	Category	Parameters	Notes
1	Location of installation.	Distance from SHP site to existing ENERCA grid/load centre. Population size and density to provide for cost-efficient connections to distribution lines.	No planned grid extension to the area for at least the next 20 years. SHP Site should be not more than 20 km from an existing load centre *(otherwise, the cost of stringing the line from the power station to the load centre may be prohibitively expensive).* Does the site offer a long-term opportunity to realise returns on investment and provide measurable impact on communities? The units to be connected (households, institutions, commercial premises, etc.) should be in close proximity to one another. The SHP site should be accessible throughout the year regardless of the weather and resulting road conditions, and must have proximity to transportation routes that can support heavy loads during construction. Selection of SHP sites with difficult road access may compromise the project's success.
2	Productivity	The site should present potential for productive uses of electricity by small entrepreneurs, SMEs, etc.	Potential for small scale businesses/SMEs. Agricultural potential, etc.

3	Payment for services	For the project to be financially viable, the potential power consumers should demonstrate: **Ability to pay**: i) Prevailing economic activities. ii) Disposable income. ii) Percentage of the population engaged in economically productive activities. **Willingness to pay:** i) Current expenditures on power/energy. ii) Quality of current power/energy sources. iii) Desire or need to consume quality power.	It is important to gauge the ability, willingness and reliability of customers to make payments to cover services costs. Supply and demand balancing (*after estimating the overall ability to pay for electricity, an additional intricacy is the gauging of potential levels of use at various prices per unit of electricity, pricing too low could lead to excessive demand, whereas pricing too high could lead to non-payment or non-use*). Lack of information about electricity supply could also lead to improper use or even misuse.
4	Presence of potentially "large" consumers	The generated power must be consumed in order to provide positive social, environmental and economic impact.	The categories of potentially "large" consumers may include businesses, institutions, administrative units, development organisations, etc.
5	Availability of feasibility study	Availability of a feasibility study, while not necessary, may assist in reducing investment costs.	Existing feasibility study may require updating.
6	Presence of community-based organisation.	Will assist in determining business opportunities.	Will constitute an important support group for operating businesses.
7	Secure generation site	Clashes, vandalism, theft, etc.	Security is a vital factor in site selection. Secure areas can be developed faster and require no special planning on how to counter or prevent insecurity occurrences.

Table 8: Criteria for site/village selection

The following information was solicited from stakeholders prior to making a decision on the potential sites to be developed under the project:
(a) What is the distance from the potential SHP site to the load centre/ENERCA mini-grid?
(b) Is the site accessible by road, preferably throughout the year?
(c) Does the load centre have relatively larger population densities?
(d) Does the potential exist for economic activities such as processing of agricultural crops, cottage industries, tourism, etc.?
(e) Presence of schools, business units, social institutions, health centres, administrative units (e.g. Police Post, Local Government office, Post office, Youth Centres, etc.)?

(f) Presence of community-based organisations/NGOs?
(g) Does the targeted community have a low petty crime rate?

In discussions with private sector investors during the process of selecting the SHP sites and villages to be electrified, they expressed concern regarding the risk of an uncompensated 'takeover' by an expanding national grid. Thus, there will be a need for regulations and procedures clarifying what will happen to the mini-grid if and when the national grid arrives, so that the timing and location thereof can be adequately incorporated into mini-grid technical and financial design. The best approach will be to manage these risks upfront, with a regulatory framework that protects investors, guarantees fair compensation, and - ideally - offers transparent information about grid extension plans (created through a rural electrification plan). Under a positive policy environment, grid connection can instead provide the opportunity for isolated mini-grid operators to retain their business and earn income by selling the electricity produced to the grid.

Information on the 4 sites selected to be developed during the 5-year project duration is summarised in Table 9 below. Procedures will be developed regarding a transparent and competitive process for the award of concessions, each consisting of a small hydropower site and a load centre, to the private sector for development. It is, however, understood that these site/village (load centre) combinations constitute a preliminary list that may be subject to change during project implementation, depending on the interest of and confirmation by the stakeholders.

Table 9: Information on potential SHP sites/villages for mini-grids.

Notes:

- The daily electricity requirements (kWh) for each site have been estimated for Year 1 of operation. It is also expected that this daily load will increase by approx. 10% every year over the next 5 years and at a slower 5% rate thereafter.
- Site No. 3 at Gamboula already has a 120-kW mini hydropower station that was built in 1986 by Swedish missionaries (an NGO) and it is still in operation. However, the river flow is such that the site can accommodate an additional 300 kW of generation capacity that can be built by a private sector developer under an NGO-Private Sector model.
- It is understood that not all four sites will be developed for operation to commence at the same time. Construction of the power stations will necessarily be staggered and each one will likely come into operation at a different time within the 5-year project timeframe.

N°	Region	Prefecture	Site and Proposed Capacity (kW)	Load Centre and distance from SHP site (km)	No. of potential households (HH)	Expected Initial Uptake Level (%)	Estimated daily electricity requirements (kWh)	Electricity services to be utilised for:	Potential large consumers to be served
1	**N°1 Plateau**	Lobaye	**Mbecko** 600 kW	**Mbaîki** 10 km from site + Existing 4.5 km ENERCA distribution grid in town.	> 3,500	60 - 70	9,360	Household appliances, Lighting, Cell-phone charging, small businesses (stores, internet cafes), tailor/barber/beauty shops, processing of agricultural crops, saw mill, welding workshop, radio, TV, freezers, computers, public lighting, etc.	Mobile phone repeater towers, Administration, Hospital, Police Station, Schools, University, Churches, Motels, Saw mills, etc.
2		Lobaye	**Gbassem** 550 kW	**Boda** 1.5 km from site + Existing 6 km ENERCA distribution grid in town.	> 2,000	60 - 70	8,580	Household appliances, Lighting, Cell-phone charging, small businesses (stores, internet cafes), tailor/barber/beauty shops, processing of agricultural crops, saw mill, welding workshop, radio, TV,	Mobile phone repeater towers, Administration, Hospital, Police Station, Schools, Churches, Motels, etc.

								freezers, computers, public lighting, etc.	
3	**N°2 Equateur**	Mambere Kadei	**Gamboula** 420 kW, including an existing capacity of 120 kW	**Gamboula** 3 km from site + Existing NGO local grid. No distribution grid in town.	> 2,500	60 - 70	4,680 (in respect of only the additional capacity of 300 kW)	Household appliances, Lighting, Cell-phone charging, small businesses (stores, internet cafes), tailor/barber/beauty shops, processing of agricultural crops, saw mill, welding workshop, radio, TV, freezers, computers, public lighting, etc.	Mobile phone repeater towers, Administration, Hospital, Police Station, Schools, Churches, Motels, etc.
4	**N°4 Kagas**	Ouaka	**Baidou** (Bac) 600 W	**Bambari** 13 km from site + Existing 8.9 km ENERCA distribution grid in town.	> 7,000	60 - 70	9,360	Household appliances, Lighting, Cell-phone charging, small businesses (stores, internet cafes), tailor/barber/beauty shops, processing of agricultural crops, saw mill, welding workshop, radio, TV, freezers, computers, public lighting, etc.	Mobile phone repeater towers, Administration, Hospital, Police Station, Schools, University, Churches, mosque, Motels, etc.

Note: Although the number of households in Mbaiki is half that of Bambari, the estimated daily electricity consumption is the same in view of the fact that Mbaiki has several saw mills for processing forestry products; such loads are absent in Bambari.

Bambari is the town capital of the Ouaka district (prefecture) and the largest city in the East Central CAR. In 2003, its population was estimated at 48,828 with an average household size of 6 persons. Several administrative buildings, schools, hospitals and businesses are established in the city and are potential electricity customers. The total electricity demand for the town is estimated at 9,360 kWh/day. Agriculture is the main economic of activity of the town. Trade and handicraft are also well developed as the town sits at the crossroads of the Western, Eastern and Northern regions of the country as well as the Democratic Republic of the Congo. Currently, households use lamps powered with non-rechargeable batteries for their lighting needs. The lamps -commonly known as Chinese lamps- cost about $3.5 and use on average 20 batteries a month at a cost of $3/month. Individual diesel generator owners offer cell phone charging service at $0.15 a charge. It is estimated that households spend on average $10/month for their basic electricity needs (lighting, phone charging, radio) for an average monthly income of $60.00.

Mbaiki has a population of 21,296 with an average household size of 6 persons. As the town capital of the Lobaye district, its houses several of the district's schools, a university, a hospital, several administrative buildings and cell phone towers for each of the main cell phone operators. Mbaiki has the advantage of being less than 2-hour drive from Bangui and close to some of the country's tourist attraction (e.g. the mausoleum and residence of the first president) and as such could be strategic tourist stop when the country is fully stable. At the moment however, agriculture and trade are the dominant economic activities. A processing plant for agriculture products has recently stopped operation because of the high cost of operating its diesel generator. Just like in Bambari, Chinese lamps are the main source of lighting and cell phones are charged from diesel generators. Electricity expenses are also estimated at $10/month while monthly household income stands at $60.

Boda is one of the towns of the Lobaye district and has a population of 11,516 as of the 2003 census. It was traditionally a large cotton and tobacco producer but lately, coffee has become the main cash crop. Artisanal diamond and gold mining is also a thriving economic activity. Average household income hovers around $65/month. The stoppage of ENERCA's plant has created several microenterprises that provide electricity to administrative offices and businesses from small diesel generators. For instance, shops can subscribe to have lighting from 6 pm to 10:30 pm for $10/month. The electricity providers consume on average 15 litres of diesel per day at $1.47/litre. In addition, some business and households –especially those owned by people active in the mining sector- have their own diesel generators or solar home systems. These systems are generally self-financed.

The town of Gamboula is at the border with Cameroon. This proximity favors the development of commercial exchanges between the city and Cameroon. There are more than thirty shops, video rooms, fish shops as well as government offices, a health center and schools. Agriculture plays an important role in the economy of Gamboula. Food crops that are grown include cassava, groundnut, and maize. Coffee and tobacco are the main cash crops but artisanal mining of diamond and gold remains an important source of income. The population of Gamboula was estimated at 14,169 at the last census with a household size of 6 persons. Since 1986, the only form of modern electricity connection has been the mini hydro plant at the Seminary whose distribution network is limited to the Seminary. Just like in Boda, some micro-entrepreneurs provide electricity to businesses that can afford the fee of $0.24/per light bulb per day. Some households have their own generators which they use occasionally but in general the Chinese lamps are the lighting source of choice. One logging company in the area uses a diesel generator 24 hours a day.

Output 3.4: Selected sustainable O&M&M model demonstrated for all mini-grid schemes.

- The Guidebook mentioned earlier under Output 2.1 indicates, among others, that "it will serve as a tool for the benefit of system designers, installers and operators to enable them to properly design, build, operate and manage small hydropower stations ...". A sustainable O&M&M model will be developed and discussed with the private sector and other stakeholders before it is finalised. It will include the following actions to be implemented, as per an established schedule, on a daily, weekly, monthly, quarterly and annual basis, as required by the equipment manufacturers: water intake and conduit system, turbine, generator, switchyard and distribution system transformers, switchgear, etc. The selected O&M&M will be adjusted, as necessary, to meet the operating conditions under which the equipment is called upon to perform. Targeted capacity development will be delivered to relevant stakeholders on the selected O&M&M procedures.

Output 3.5: Productive use promoted to increase electricity demand at the targeted sites.

- Capacity development of the rural population, especially women, to embark upon income generating activities that utilise electricity.
  Access to electricity services in the rural areas opens up opportunities for its use to engage in income-generating activities associated with processing of agricultural products such as cassava, corn, sorghum, millet and peanuts. This will add value to the crops by enabling the farmers to secure higher prices through their sale in processed form rather than as raw products. The availability of electricity can and will also promote such activities as furniture making, juice production and refrigeration from locally grown fruits, welding, tailoring, sharpening of machetes/knives, refrigeration of fresh "forest worms" (locally known as "chenilles or makongo") during the rainy season (this "fresh" harvest of forest worms commands attractive prices from Bangui-based traders due to their high protein value), etc.
  As engaging in productive activities will increase the disposable income of some rural households and with the availability of electricity, it might be worthwhile to pilot single-plate Induction Cookers – several brands are manufactured in China, for example. Induction Cookers are compact, portable, lightweight, efficient and affordable, retailing for approx. $ 65/unit. Cooking with induction cookers does not generate any smoke nor soot and keeps the surface of the cooking pots clean. Induction cookers have the potential to move some households away from utilising wood fuel or charcoal for cooking, thus decreasing the pressure on forests and leading to reduced deforestation.

Component 4: Knowledge Management and Knowledge Sharing

Outcome 4: Increased awareness about SHP potential, investment climate and gender mainstreaming. The expected outputs are:

Output 4.1: National Plan to implement outreach/promotional activities targeting both domestic and international investors.

- National Plan to implement outreach/promotional activities targeting both domestic and international investors. This will include the preparation of promotional materials, briefing sessions with investors who are already active in the energy/renewable energy field in the country, local businesses that have interest in expanding their activities to include energy for the rural areas and, potentially, organising road shows to attract foreign investors to establish consortia with local businesses to provide the rural areas with modern energy services.

Output 4.2: Published materials (including video) and informational meetings with stakeholders on project experience/best practices and lessons learned.

- Capacity development of concerned Ministries/Institutions to monitor and document project experience. On-the-job training will be provided by international/local consultants, during the course of their inputs and at

mid-term project review/terminal evaluation, to the stakeholders on how to monitor, record/document project experience.

Output 4.3: Dissemination of project results and lessons learned within the country and in the region.

- Project results on best practices and lessons learned, in electronic form, will be widely disseminated throughout the region and among those countries planning to implement similar hydropower-based mini-grids for rural electrification. These will also be posted on the project website. In addition, towards completion of project activities, an information-sharing event involving the participation of all in-country stakeholders and international participants will be organised to discuss lessons learned and next steps towards replication of results throughout the country/region.

Output 4.4: Dissemination of lessons learned on mainstreaming gender in the project

- The project will document approaches taken to mainstream gender in activities related to Output 2.2 (on-the-job capacity development), output 2.3 (business and technical advisory services), output 3.2 (public private partnership for the exploitation of SHP) and output 3.5 (promotion of productive use) as well as barriers (if any) and successes for achieving a gender balance in these activities. These lessons will be disseminated in conjunction with Output 4.3 but more importantly, they will be used to identify gender capacity building needs for SHP projects and other energy-related projects.

Key Indicators, Assumptions and Risks

Indicators

Key indicators of the project's success will include:

- 4 small hydropower mini-grids operational and providing modern energy services to over 1,000 rural households, each consisting of an average of 6 persons.
- Direct CO_2 emissions avoided by 327,250 tonnes (without replication), under the assumption of a 25-year equipment projected life.
- Consequential post-project CO_2 emissions with replication avoided by 4,550,000 tonnes, again assuming a 25-year equipment projected life and 80% GEF causality factor.
- 39,770 MWh generated by project end and an annual electricity generation of 14,535 MWh sustained over an expected 25-year projected life of the PV systems installed under the project.
- Capacity developed within Directorate General for Energy, ARSEC, ACER and other relevant Ministries/ Government Departments to promote investment in small hydropower isolated mini-grids for rural electrification.
- 150 jobs created at SHPs/mini-grids and 400 more jobs in income-generating activities during the project period; at least 40% of these jobs being for women.
- Over 10,000 rural households and small commercial/industrial enterprises connected to electricity services by project end.
- Lessons learned documented and distributed to potential investors/stakeholders through publications, public awareness campaigns and project website.

Detailed indicators are provided in the Project Results Framework further below.

Assumptions

The assumptions are outlined in the Project Results Framework further below.

Risks

The project presents some risks which are discussed in the Table 12 further below:

Financial modality

The project is aimed at policy development, capacity building, technical assistance and the provision of financial incentives to catalyse private sector investment in the development and utilisation of renewable energy-based mini-grids for rural electrification. A substantial portion of GEF climate change resources will be allocated to the financial instrument that will provide financial incentives to private developers for the 4 SHP.

The project objective will be attained through technical assistance and facilitating third parties' investment in renewable energy-based mini-grids for rural electrification. No loan or revolving-fund mechanisms with GEF funds are considered appropriate, and, therefore, grant-type funding is considered as the most suitable to enable successful delivery of the project outcomes.

ii. Mainstreaming gender:

Gender will be mainstreamed in all the activities planned by the project. To facilitate such action, a gender expert will be part of the Project Board, members of the Project Management Unit will receive training on gender mainstreaming and be supported periodically by a gender expert.

The development and operation of SHP mini-grids is expected to be male-dominated because women are generally absent from sectors considered too technical and that require heavy capital investments. However, even without the technical know-how, business-women can recruit engineers in their team and run a SHP mini-grid successfully. In selecting private developers for the 4 sites in component 3, women entrepreneurs will be strongly encouraged to apply. In the capacity building component, an emphasis will be put on including as many women as men and particularly tailoring some of the training to recent high school and college graduates, a group that may have a higher presence of young women.

On the demand side, access to electricity will help create or expand small enterprises. Component 3 (output 3.5) will target women groups and individual women entrepreneurs. Further, project developers will be sensitized on how to respond to the different electricity needs of men and women. For instance, when consulting with the population, project developers should ensure that women are well represented and are gathered in a setting that allows them to freely voice their opinion. In market studies, both men and women should be surveyed. In general, only heads of the household (mostly men) are asked their opinion which does not always reflect the needs of women in the household. Women-headed households are a particularly vulnerable group that should benefit from a "social tariff" or flexible payment terms. Data that is fully representative of the target population will help the developer design an inclusive marketing approach that will in turn, expand the client base.

Finally, the experience garnered in mainstreaming gender throughout the project will be documented and shared with a wider audience (Component 4, output 4.4). It will also form the basis for identifying capacity building needs for conducting gender inclusive energy projects in the future.

iii. South-South and Triangular Cooperation (SSTrC):

UNDP has a strong role to play as knowledge broker, capacity development supporter and partnership facilitator when developing countries work together to find solutions to common development challenges. This UNDP-GEF project will support South-South and Triangular Cooperation (SSTrC) through cooperation modalities that will involve bi-lateral knowledge exchange on implementation procedures, technology transfer and opportunities for income-generating associated with other small hydropower projects presently being implemented by UNDP in Congo-Brazzaville, Congo Kinshasa, Equatorial Guinea and Sao Tome and Principe. In addition, collaboration will be sought with other countries in Asia and Latin America and the Caribbean where similar projects have been/are being implemented by UNDP-GEF.

V. FEASIBILITY

i. Cost efficiency and effectiveness:

As discussed above in presentation of renewable energy options, hydropower is considered the most promising source of renewable energy in the Central African Republic, followed by solar energy and biomass. Thermal power, using diesel fuel, although the second-most used source of electricity in the country, is not financially viable as CAR is a net importer of petroleum products.

Globally, hydropower is considered one of the most cost competitive source of electricity with a levelized cost of energy (LCOE) as low as USD 0.02 compared to USD 0.06 and USD 0.14 for wind and solar respectively. In CAR specifically, the LCOE comparison for a hypothetical 1MW power plant running on hydroelectricity, solar PV, biomass and diesel shows that levelized cost is $0.04 for hydro, $0.07 for biomass, $0.27 for solar PV and $0.40 for diesel. This demonstrates the cost-effectiveness of generating electricity from hydropower in the country, compared to the alternative of utilising imported diesel fuel for that purpose or even using other renewable energy sources.

The LCOE calculation is based on the ratio of discounted lifetime cost and discounted lifetime generation as used by IRENA in its renewable cost analysis series and excludes externalities such as CO2 emissions and health impacts as well as any exemptions of import duties on renewable energy technologies. The full LCOE analysis is provided in Annex 9.

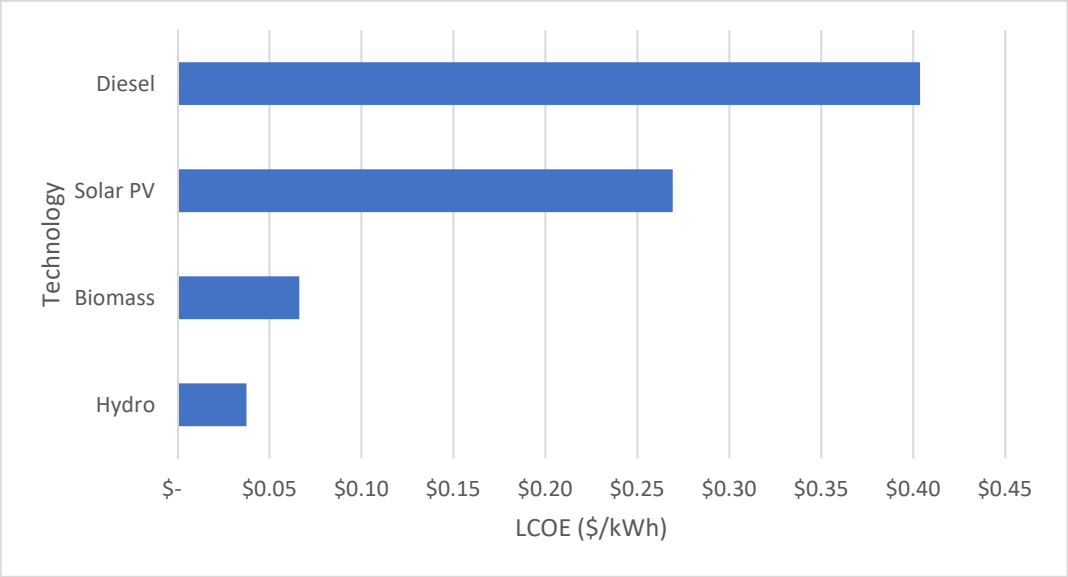


Fig. 6: LCOE comparison in CAR

It can be argued that utilisation of biomass, solar and wind energy to generate electricity in these isolated mini-grids (especially in the cases of Mbecko and Baidou which are 10 and 13 km, respectively, from the load centres, thus increasing the capital cost due to the medium voltage transmission line) in lieu of small hydropower stations could provide a lower LCOE and a correspondingly lower per unit emission abatement cost. However, as indicated earlier, CAR does not yet have any experience with grid-electricity generation from biomass, solar or wind in replacement of diesel fuel; hence, it is very difficult to determine generation costs in real-life situations, unlike the case of small hydropower where several plants are operating in Bangui.

The project is expected to be approved in time to commence activities in early 2018. Under this scenario, activities addressing the policy, regulatory and institutional issues should be completed within 12 months, i.e. by Month 12, including fully established procedures for determining tariffs (MMEH allows for differentiated tariffs in different parts of the country, based on the local cost of electricity generation) and signed PPP partnerships. Then, priority will be given to the power stations at Mbecko (to supply Mbaiki), Gbassen (to supply Boda) and Baidou (Bac) (to supply Bambari) in view of existing feasibility sites, albeit old, for these sites, thus necessitating relatively smaller capital investments for updating them, with the power station at Baidou (Bac) being the last one to come on line. In addition, it is also assumed that while the start of activities regarding the construction of the 4 small hydropower stations will be staggered, the actual construction works may run concurrently; thus, there will be no need to await completion of one hydropower plant before construction on the next one can start.

Accordingly, it is assumed that Mbecko 600-kW SHP will come on line in Month 18, followed by Gbassen (550 kW) coming on line in Month 22, Gamboula (300 kW additional to existing 120 kW) in Month 26 and, finally, Baidou (Bac - 600 kW) in Month 30. Hence, by Month 30, all 4 small hydropower plants with a total installed capacity of 2.05 MW would be fully operational.

Table 10: Electricity generation from small hydropower plants installed under project.

Site / Year	Mbecko, MWh)-operational from July 2019	Gbassen, MWh)-operational from Nov 2019	Gamboula, MWh)-operational from March 2020	Baidou, MWh)-operational from July 2020	Total/year (MWh)
2018	-	-	-	-	
2019	1,710	510	-	-	2,220
2020	3,760	3,140	1,380	1,710	9,990
2021	4,135	3,450	1,880	3,760	13,225
2022	4,550	3,780	2,070	4,135	14,535
Total/Site	14,155	10,880	5,330	9,605	
Cumulative Total over project time-frame					**39,770**

As per the construction completion schedule described above, electricity generation will be 2,220 MWh during Year 2 of the project (Table 10) and, respectively, 9.990 MWh, 13,225 MWH and 14,535 MWh during Years 3, 4 and 5 of the project. Thus, by project completion, some 39,770 MWh would have been generated and an annual generation of 14,535 MWh will be sustained over an expected 25-year projected life of the equipment. All this hydro generation, if not implemented, would have otherwise been accomplished through thermal power stations burning imported diesel fuel, with an emission factor of 0.875 tCO_2/MWh (Ref. Second National Communication to UNFCCC). Consequently, during the 5-year project period, almost 35,000 tonnes of CO_2 would have been avoided as a direct result of hydropower electricity generation. Furthermore, these 4 small hydropower plants will continue avoiding almost 13,000 tonnes of CO_2 annually during their remaining 21-23 years of project life. When one looks at the 25-year lifetime of the hydropower stations earmarked for development during the 5-year project period, the power stations would have generated 374,000 MWh, thus avoiding 327,250 tonnes of CO_2; this is equivalent to $ 7.7 of GEF funds per tCO_2.

Finally, under the assumption of the interest generated in small hydropower-based mini-grids during project implementation and given the conducive environment for investment that the project would have created, the estimated

total replication potential of small hydropower plants in the Central African Republic with the participation of private sector investors (estimated at 40 MW over the next 10 years of "project influence", in view of the 2,000 MW hydropower potential of the country) is several times greater than what will be achieved during the five-year project implementation. Thus, the consequential post-project emission reduction estimates related to only the additional capacity amounting to 35 MW – on the basis of a conservative policy scenario and a GEF causality factor of 80% (top-down approach) -- can be computed at 4,550,000 tons of CO_2 avoided, which translates into an abatement cost of $ 0.52 of GEF funds per tCO_2 avoided. In the case of the bottom-up approach, with a replication factor of 3 (in view of the market transformation potential and associated capacity development), the consequential post-project emission avoided are computed to be 780,000 tons of CO_2.

Table 11: Project GHG emission reduction impacts

Time-frame	Direct project without replication (25-year equipment projected life).	Consequential post-project (top-down) with replication over next 10 years of project influence).	Consequential post-project (bottom-up)
Total CO_2 emissions reduced (tonnes)	327,250	4,550,000	780,000
Unit abatement cost ($/tonne CO_2)	7.7	0.52	3.23

ii Risk Management:

As per standard UNDP requirements, the Project Manager will monitor risks quarterly and report on the status of risks to the UNDP Country Office. The UNDP Country Office will record progress in the UNDP ATLAS risk log. Risks will be reported as critical when the impact and probability are high (i.e. when impact is rated as 4 and probability is rated at 3 or higher). Management responses to critical risks will also be reported to the GEF in the annual PIR.

Table 12: Project Risks					
Description	**Type**	**Probability & Impact**	**Mitigation Measures**	**Owner**	**Status**
Civil Conflict: CAR is a post-conflict situation, but there are still some pockets of unrest in some parts of the country and this could derail smooth project implementation.	Political	P=4 I=5	UNDP has played and will continue to play a key role to resolve the political crisis that feeds into the civil unrest. UN Security continuously monitors the country situation and implements adaptation strategies as warranted by events on the ground. With this in mind and out of an abundance of caution, the project sites were selected in areas where the situation is relatively calm and where the possibility conflicting situations flaring up are minimal. Evolution of the conflict situation will be closely monitored by the UNDP Country Office security team, which will be regularly consulted during the course of project preparation and implementation and their inputs and advice will be sought on the security situation at the prospective project sites. Also, community involvement and consultation will be an integral part of project activities in order to ensure buy-in and minimize the risk of conflict escalation and other potential tensions.	UNDP CO	No change
Policy: Lukewarm support for a framework to encourage the private sector to invest in small hydropower-based mini-grids for rural electrification.	Operational	P=3 I=3	There exists the possibility that the Government may not act soon enough on a policy framework that will encourage the private sector to invest in small hydropower-based mini-grids for rural electrification; as examples, there is no Rural Electrification Masterplan and the 2005 Electricity Code authorising the private sector (IPPs) to generate electricity in the country either for sale to the ENERCA network or to operate an isolated mini-grid has not yet materialised into a single investment in the absence of the accompanying guidelines and procedures for private sector participation in the electricity sub-sector. If this were to happen, project implementation will get hampered. However, the Government is strongly motivated to provide access to	UNDP CO	No change

			modernised energy services to the large rural population that utilises traditional forms of energy, to improve their quality of life and for income-generating activities, and is driven by its plans to meet the Sustainable Development Goals. Towards this end, it only very recently issued a draft Decentralised Energy Policy, thus sending the right signal to stakeholders. The donor community, including AfDB, EU and the World Bank, is also working with the Government to have the right policy for rural electrification in place and it is hoped that this will encourage the Government to approve the Decentralised Energy Policy in the very near future, very likely this year (in 2017). Moreover, project interventions under Component 1 will assist in mitigating this risk.		
Financial risk: Widespread poverty among the population, resulting from a lack of a sustainable source of income can result in their decreased ability to pay for electricity services.	Operational	P=3 I=3	The project has deliberately decided to target those Prefectures/Sub-Prefectures with already existing but non-performing ENERCA mini-grids. In these locations, there is already a history of the consumers' capacity and willingness to pay when the mini-grids were energised. In addition, socio-economic surveys implemented during the PPG reveal that households do already spend a good share of their income on alternatives, such as dry cell batteries for lighting and radios, together with daily expenses for charging their mobile phones. Finally, the availability of electricity will enable them to engage in productive activities, thus boosting their capacity to pay for their electricity consumption. All this is addressed under Component 3 and points towards the financial risk not being too much of a cause for concern.	UNDP CO	No change
Lack of Investor Appetite: CAR ranks in the 185th place among 190 countries in "Ease of doing Business", as per the	Operational	P=4 I=4	The fact that CAR ranks in the 185th place among 190 countries in "Ease of doing Business", as per the WB/IFC "Doing Business 2017" publication might act as a deterrent for investors in hydropower technology, although this has not tempered investors' willingness to invest in the diamond and forestry industries to benefit from business opportunities available in the country. In any case, with this in mind, the project will put in place a Financial Support Scheme under	UNDP CO	No change

WB/IFC publication "Doing Business 2017.			Component 1 that will be directed at minimising the financial risks that lenders and investors may face in doing business targeting hydropower development for rural electrification through mini-grids.		
Technology: Small hydropower and other electrical equipment of poor quality introduced in the country.	Operational	P=3 I=3	Poor quality SHS and their shoddy installation utilising 12 V car batteries have been introduced in CAR, albeit on a limited basis, and these have been prone to frequent failures, thus shaking the confidence of the users. Hence, the project will assist the Government under Component 2 to ensure that there is no repeat of such unfortunate experience with regard to hydropower equipment components and other electrical equipment by putting in place, through its Department of Standards and Quality Assurance (DSQA), strict controls on the standards of hydropower and other electrical equipment that can be imported and installed in the country. In addition, the Government will ensure that all installations and maintenance should be undertaken only by licensed and certified technicians as per established electricity codes.	UNDP CO	No change
Climate: Climate change can cause increased variability in CAR's hydrological regime and precipitation patterns which may pose challenges to SHP development that can affect energy planning and infrastructure investments.	Operational	P=3 I=3	There are multiple environmental risks, as outlined in CAR's Second National Communication to UNFCCC (e.g. reduced rainfall that can affect water flows, land and watershed degradation due to erosion and population pressures) that can negatively affect water flow, thereby affecting outputs from SHP stations. This risk will be mitigated through capacity development of Government staff on the key aspects to address national challenges associated with weather, climate and climate change. In addition, policy recommendations for SHP promotion will include regulations under Component 2 to protect watersheds in order to maintain the necessary vegetation/forest cover.	UNDP CO	No change

P = Probability on a scale from 1 (low) to 5 (high). **I** = Impact on a scale from 1 (low) to 5 (high).

iii Social and environmental safeguards:

At the PIF stage, the potential Social and Environmental risks were identified through the Social and Environmental Risk Screening Checklist. During project preparation, the SESP analysis was thoroughly revisited to explore each Social and Environmental risk in detail. Each risk identified is defined and rated according to its level of 'impact' and 'probability' rated on a scale of 1 (low) to 5 (high) for each risk. Depending on the combination of both scores, risks are considered either: Low, Moderate or High significance. Furthermore, assessment and management measures are formulated to address risks with Moderate and High Significance. For a full description of social and environmental safeguards employed by the project please see Annex 10: UNDP Social and Environmental and Social Screening Template (SESP).

The present project design includes the identification of the potential locations for the small hydropower stations through working with stakeholders. It is expected that the details of certain components of the project will not be known at the time of project approval and therefore the E&S safeguards cannot be fully assessed. Under this scenario and according to the latest UNDP SES guidelines, the SESP is still applied, disclosed and discussed with stakeholders prior to implementation to identify potential risks even if they cannot yet be fully assessed.

Environmental and social grievances will be reported to the GEF in the annual PIR.

iv Sustainability, Replicability and Scaling Up:

Sustainability

(a) Technical Sustainability: From a technical point of view, the viability of tapping hydropower, either for supplying the main grid or isolated mini-grids for rural electrification has now been demonstrated in several developing countries, including some located in Africa. By addressing the non-technical barriers that impede the development of hydropower based mini-grids in the Central African Republic, the project will assist in creating a sustainable niche through strengthening the policy, institutional, legal, regulatory and operational capabilities of the key national institutions, supporting the development of the technology through a market-driven approach, developing national capabilities and disseminating information. These efforts should ensure the long-term sustainability of hydropower-based mini-grids for rural electrification in the country.

(b) Financial Sustainability: From a financial point of view, the project will support the integration of local manpower and industries into the hydropower-based mini-grid sector. This will be achieved through the provision of focused support to households willing to venture into small income-generating activities utilising electricity, capacity development of technical personnel and local specialised engineering workshops for manufacturing the required ancillary supporting equipment and engineering firms in the design, construction, installation, operation, maintenance and repair of the renewable energy-based systems. With the increase over time in renewable energy-based mini-grid installations, it is envisaged that such efforts will intensify with opportunities for job creation with additional players entering this field.

With regards to the financial support provided to project developers, the key to sustainability is a recognition by the loan guarantee funds (FNGI and FAGACE) that SHP are viable investments. Reaching that point will mean keeping them involved throughout the project and preparing project developers for investment. The latter will be ensured by the financial support for pre-project studies while the former will be reinforced by the project management team. Already, the Ministry in charge of the FNGI has been actively engaged in inception and validation of this project and will be made part of the project steering committee. Once the Funds are on board, financial institutions will be open to lending to projects developers and will ultimately extend these loans to pre-projects studies, especially if these studies can also be covered by the loan guarantee. At that point, grants may no longer be necessary.

But, in addition to on-boarding the guarantee Funds, it is important to keep the private sector involved by making developers aware of the SHP investment opportunities, educating financial institutions on the particularities of investments in the renewable sector and reinforcing the role of government and development partners as enablers.

With regards to developers, the countries two main professional associations the Union Nationale du Patronat Centrafricain (UNPC) and the Groupement Inter-professionnel de la Centrafrique (GICA) will be kept regularly informed of the project's progress. In addition, the success of the first 4 plants will be showcased using meeting platforms, newspapers, trade associations newsletters, etc. Regular gathering will be organized to share experiences, lessons learned and challenges. Component 4 of the project is tasked with this activity.

(c) Socio-economic Sustainability: The project fully endorses the human rights-based approach and will not lead to any adverse impacts on enjoyment of human rights (civil, political, economic, environmental, social or cultural) of any key or potential stakeholders, communities involved or the population at large.

The project will focus on the provision of decentralized modern energy services to the rural population and, in the process, demonstrate the benefits that hydropower technology can provide to improve livelihoods in the rural areas. These relate to social and economic benefits in the villages in terms of a healthier environment for the rural population, opportunities for income-generating activities and improved natural resource management. A particular attention will be put on increasing the role of women as actors in the energy sector rather than mere beneficiaries. Women entrepreneurs will be encouraged to run SHP installations. Those who are engaged in the processing and conditioning of agricultural products will be the focus of the promotion of electricity for productive use. Further, on-the-job capacity building for SHP (Output 2.2) will geared at both men and women. These activities combined will help reduce the gender gaps that traditionally exist in the energy sector.

In addition, the utilisation of hydropower for the provision of these services, in lieu of imported fossil fuel, will reduce the country's GHG emissions and contribute to a safer environment for the rural population. In doing so, capacity development for electricity consumers will emphasise the importance of best practices in energy management and the use of energy efficient devices such as turning off on lights/radios/TVs when not in use, use of LEDs for lighting, utilisation of energy efficient appliances/motors, etc.

(d) Environmental Sustainability: CAR will draw upon all their strategies for addressing climate change to systematically mainstream climate change considerations in small hydropower development. This will aid decision-making on energy infrastructure and service delivery options to take into account the uncertainty associated with climate change predictions and to assess the climate resilience of different options. For instance, decisions to invest in hydropower should take into account possible changes in the hydrology regime (including possible changes in precipitation patterns, increased demand for irrigation, and associated energy inputs). The project will ensure that the agencies tasked with the country's climate change portfolio are actively engaged in the project coordination mechanism so as to promote an integrated approach.

The project will have a direct positive effect on environmental sustainability, as the primary objective of the project is to accelerate utilisation of small hydropower technology for the global good of the rural population. This will be beneficial to both the country's economy and to the global environment, through the reduction of greenhouse gas emissions.

Replicability

The Project's potential for replicability within the country is very good in view of the fact that 61% of the country's population live in the rural areas with no access to electricity or modernised energy services. This represented 3.1 million of CAR's population in 2016 and constitutes some 450,000 households. The project will adopt a bottom-up approach within the overall policy/investment framework that is envisaged to be developed to promote renewable energy-based mini-grids for rural electrification. Technical assistance for barrier removal and institutional strengthening to be provided under the project will facilitate such replicability since it will create the required institutional, policy and technical conditions to enable the generation of renewed investor interest for the development of additional projects in this field. Moreover, the lessons learned will be of great value to the neighbouring countries sharing a similar resource

base, should they (in addition to Congo-Brazzaville and Congo-Kinshasa, where small hydropower UNDP-GEF projects are being implemented) decide to tap into their respective renewable energy resource base for isolated mini-grid rural electrification.

Scaling Up

As indicated above, 61% of the country's population live in the rural areas with no access to electricity services. With regard to the annual per capita electricity consumption in the country as a whole, it is 28 kWh (Energy Information Report, 2016), significantly below the African average of 579 kWh and the world average of 2,777 kWh. On the other hand, the country possesses a potential of over 2,000 MW of hydropower resources, but only a very small 1% of this potential has been developed. This situation, therefore, presents a huge potential for scaling up, utilising a sound business model and capacity development on small hydropower provided to stakeholders at various levels, coupled with an aggressive awareness/outreach programme, that will encourage private sector participation in small hydropower electricity generation to meet the needs of rural consumers in isolated mini-grid configurations and in line with the proposed Decentralised Energy Policy that will aim at providing "access to electricity services to all rural and urban residents at an affordable cost".

VI. PROJECT RESULTS FRAMEWORK

This project will contribute to the following Sustainable Development Goal (s): Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all; Goal 13: Take urgent action to combat climate change and its impacts; and Goal 5: Achieve gender equality and empower all women and girls.
This project will contribute to the following country outcome included in the UNDAF/Country Programme Document: CAF-Outcome 33: The population and public and private sector stakeholders utilise natural resources in more rational manner, improve food and energy security and are less vulnerable to crises.
This project will be linked to the following output of the UNDP Strategic Plan: Output 1.5: Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy).

	Indicator/ *Sub-Indicator*	**Baseline**	**Targets Mid-Project**	**Targets End of Project**	**Sources of Verification**	**Risks and Assumptions**
Objective						
To promote investment in small hydro-power (SHP) mini-grids and develop an appropriate business model for the sustainability of the provision of rural energy services.	Emission reduction (in tCO_2 over 25-year project equipment lifetime). Investment in SHP. Capacity installed (MW) and annual energy produced (MWh) by SHP stations. Number of jobs created. Number of beneficiary households and	GHG emissions in the country were 116 million tonnes in 2010 and are expected to increase to 189 million tonnes by 2050. The present contribution of SHP stations in the provision of rural energy services is negligible. No investment taking place in the provision of	1 MW of SHP capacity installed, resulting in $ 8 million in investment. Cumulative SHP-based electricity generation of 12,210 MWh. Cumulative reduction of 10,684 tonnes of CO_2. Total of 200 jobs created. 3,500 beneficiary households and 500 small	2 MW of SHP capacity installed, resulting in almost $ 16.7 million in investment. SHP-based electricity generation of 14,535 MWh/year. Reduction of 327,250 tonnes of CO_2 over the 25-year lifetime of the SHP stations. Estimated cumulative consequential GHG emission reduction of 780,000 tonnes of CO_2 by 2038, applying a replication factor of 3. Total of 550 jobs created.	Project's annual reports, GHG monitoring and verification reports. Project mid-term review and terminal evaluation reports.	Continued commitment of project partners, including Government agencies and investors/developers.

	Indicator/ *Sub-Indicator*	Baseline	Targets Mid-Project	Targets End of Project	Sources of Verification	Risks and Assumptions
	enterprises in rural areas.	rural energy services through SHP mini-grid electricity generation.	commercial/industrial businesses in rural areas.	Over 6,000 beneficiary households and 1,000 small commercial/industrial businesses in rural areas.		
Component 1: Policy and financial instruments and incentive scheme for small hydropower (SHP) based mini-grids						
Outcome 1: Institutional and financial viability of SHP mini-grid ensured.	Policies and strategies for SHP development approved and operational.	Not available at the present time.	Completed and approved by Government within 9 months of project initiation.	Already completed and approved by Government.	Project documentation.	Commitment of Government entities.
Output 1.1: Policy package to develop and operate SHP-based mini-grids adopted.	*Availability of policy package for SHP mini-grid development.*	Not available at the present time.	Completed and approved by Government within 9 months of project initiation.	Already completed and approved by Government.	Project documentation.	Cooperation and interest of Government entities.
Output 1.2: Financial instrument to support SHP mini-grid development, adopted and implemented	*Existence of financial instrument to support SHP mini-grid development.*	Not available at the present time.	$ 8 million invested (total from financial instrument, developer's investment and other investments)	Additional $ 8.7 million invested.	Reports on completed village energisation projects.	Continued interest of private sector investors.
Output 1.3: Tariff criteria for SHP- based mini grids defined.	*Availability of criteria to define tariffs for SHP.* *Existence of approved tariffs for SHP.*	None available at the present time. None available at the present time.	Completed within 12 months of project start. Draft available for discussions.	Already completed. Completed within 12 months of project end.	Project reports. Project reports.	Continued interest of the private sector.

	Indicator/ *Sub-Indicator*	Baseline	Targets Mid-Project	Targets End of Project	Sources of Verification	Risks and Assumptions
Output 1.4: Dedicated window at national clearinghouse (one-stop shop) for SHP developers established.	*Existence of dedicated window at national clearing house/one-stop shop.*	Not available at the present time.	Completed within 10 months of project initiation.	Already completed.	Project documentation.	Expected expansion of programme. Cooperation of Government entities and staff.
Component 2: Capacity Development for SHP based mini-grid system operation, maintenance and management (O&M&M).						
Outcome 2: Capacity to deliver turnkey solutions and quality O&M&M services for SHP developed.	Completion of capacity development activities of stakeholders.	Not available at the present time.	Completed within 12 months of project initiation.	Already completed.	Project documentation.	Cooperation of all stakeholders.
Output 2.1: Published Guidebook on SHP-based mini-grid development.	*Availability of Guidebook on SHP-based mini-grid development.*	None available at the present time.	Completed within 12 months of project initiation and Guidebook validated by stakeholders by the end of Year 1.	Already completed and Guidebook validated.	Published documents.	Commitment of the various Government institutions and NGOs.
Output 2.2: On-the-job capacity development programme for SHP (men and women) plant developers delivered, including on plant design, construction, equipment selection, assembly and O&M.	*Availability of programme for on-the-job capacity development.*	Not available at the present time.	5 interested SHP developers/equipment manufacturers trained by mid-project.	Another 10 interested SHP developers/equipment manufacturers trained by end of project.	Project reports.	Continued commitment of project developers.
Output 2.3: Business and technical advisory	*Existence of efficient*	Not available at the present time.	Completed within 12 months of project	Already completed.	Evidence of fully operational	Continued commitment of the various

	Indicator/ *Sub-Indicator*	Baseline	Targets Mid-Project	Targets End of Project	Sources of Verification	Risks and Assumptions
services to mini-grid plant developers (men and women).	*business and technical advisory services.*		initiation. 10 staff trained in the provision of such services.	Already completed.	advisory services Unit. Project reports.	Government institutions and project developers.
Output 2.4: Tailored capacity development programme delivered to relevant national agencies.	*Evidence of capacity development programme delivered to appropriate national agencies.*	Not available at the present time.	Completed within 12 months of project start. 10 staff from national agencies trained.	Already completed. Already completed.	Project documentation.	Designation of staff by relevant Government Departments/other Institutions.
Component 3: SHP-based mini-grids roll-out.						
Outcome 3: A functioning business model is demonstrated for the technical and financial viability of small hydro-based plants.	Business model defined, demonstrated and ready for widespread use.	No such model available now.	Completed within 12 months of project start.	Already completed.	Project reports.	Government entities and private sector willing to cooperate.
Output 3.1: 8 sites for mini-grids identified and assessed, and institutional/investment model defined.	*Existence of completed full feasibility studies and business plans or prefeasibility studies for the 8 identified sites.*	No such feasibility studies/business plans available at the present time.	Completed within 12 months of project start.	Already completed.	Project reports.	Continued interest of Government and private sector.
Output 3.2: At least 4 public private partnerships are established for the	*Existence of fully-executed partnership documents.*	None at the present time.	Completed within 24 months of project start.	Already completed.	Contracts confirming the setting up of partnerships.	Continued interest of Government entities and private investors.

	Indicator/ *Sub-Indicator*	Baseline	Targets Mid-Project	Targets End of Project	Sources of Verification	Risks and Assumptions
exploitation of SHP plants and mini-grids.						
Output 3.3: 2 MW of SHP-based power generation capacity.	*Evidence of at least 2 MW of SHP generation capacity being operational.*	None at the present time.	1 MW completed.	An additional 1 MW completed.	Reports that a total of 2 MW hydropower capacity has been constructed and is operational.	Continued interest of Government entities and private investors.
Output 3.4: At least 2 selected sustainable O&M&M model demonstrated for all mini-grid schemes.	*Evidence of selected sustainable model.*	Not available at the present time.	Completed within 12 months of project initiation.	Already completed.	Project documentation.	Continued interest of Government entities and private sector.
Output 3.5: Productive use promoted to increase electricity demand in the 8 targeted sites.	*Evidence of productive use of electricity.*	Negligible at the present time.	Evidence of productive use of electricity.	Improved standard of living of rural population.	Project reports.	Interest and willingness of electricity consumers to embark upon income-generating activities.
Component 4: Knowledge management and knowledge sharing.						
Outcome 4: Increased awareness about SHP potential, investment climate and gender mainstreaming	Public relations and investment promotion programme defined, approved and ready for roll-out.	Lack of sufficient information to pursue programme.	Evidence of increased awareness among stakeholders.	Increased awareness among stakeholders in place to promote and develop SHP-based mini-grids for village energy services.	Project final report and web site.	Growth of programme will be sustained.
Output 4.1: National Plan to implement outreach/promotional activities targeting both	*Plan for public relations and investment promotion*	No such plan available.	Completed within 24 months of project initiation.	Already completed.	Project reports.	Designation of staff by relevant Government Departments/other Institutions.

	Indicator/ *Sub-Indicator*	Baseline	Targets Mid-Project	Targets End of Project	Sources of Verification	Risks and Assumptions
domestic and international investors.	*available and operationalised.*					
Output 4.2: Published materials (including video) and informational meetings with stakeholders on project experience/best practices and lessons learned.	*Existence of published material.*	Lack of information on best practices and lessons learned.	Sharing of limited available information.	Completed within 3 months of project end.	Project documentation and website.	Continued interest of stakeholders.
Output 4.3: Dissemination of project results and lessons learned within the country and in the region.	*Existence of dissemination products and tools.*	Absence of project results and lessons learned.	Sharing of limited available project results.	Completed within 3 months of project completion.	Project documentation and website.	Interest of local (and international) stakeholders.
Output 4.4: Dissemination of lessons learned on mainstreaming gender in the project	*Products documenting gender mainstreaming activities, barriers and successes*	Absence of project report	Sharing of limited lessons learned on gender mainstreaming.	Completed within 3 months of project completion	Project documentation and website	Commitment of project staff in implementing a gender inclusive project

VII. MONITORING AND EVALUATION (M&E) PLAN

The project results as outlined in the project results framework will be monitored annually and evaluated periodically during project implementation to ensure the project effectively achieves these results.

Project-level monitoring and evaluation will be undertaken in compliance with UNDP requirements as outlined in the UNDP POPP and UNDP Evaluation Policy. While these UNDP requirements are not outlined in this project document, the UNDP Country Office will work with the relevant project stakeholders to ensure UNDP M&E requirements are met in a timely fashion and to high quality standards. Additional mandatory GEF-specific M&E requirements (as outlined below) will be undertaken in accordance with the GEF M&E policy and other relevant GEF policies.

In addition to these mandatory UNDP and GEF M&E requirements, other M&E activities deemed necessary to support project-level adaptive management will be agreed during the Project Inception Workshop and will be detailed in the Inception Report. This will include the exact role of project target groups and other stakeholders in project M&E activities including the GEF Operational Focal Point and national/regional institutes assigned to undertake project monitoring. The GEF Operational Focal Point will strive to ensure consistency in the approach taken to the GEF-specific M&E requirements (notably the GEF Tracking Tools) across all GEF-financed projects in the country. This could be achieved for example by using one national institute to complete the GEF Tracking Tools for all GEF-financed projects in the country, including projects supported by other GEF Agencies.

M&E Oversight and monitoring responsibilities:

Project Manager: The Project Manager is responsible for day-to-day project management and regular monitoring of project results and risks, including social and environmental risks. The Project Manager will ensure that all project staff maintain a high level of transparency, responsibility and accountability in M&E and reporting of project results. The Project Manager will inform the Project Board, the UNDP Country Office and the UNDP-GEF RTA of any delays or difficulties as they arise during implementation so that appropriate support and corrective measures can be adopted.

The Project Manager will develop annual work plans based on the multi-year work plan included in Annex 1, including annual output targets to support the efficient implementation of the project. The Project Manager will ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality. This includes, but is not limited to, ensuring the results framework indicators are monitored annually in time for evidence-based reporting in the GEF PIR, and that the monitoring of risks and the various plans/strategies developed to support project implementation (e.g. gender strategy, KM strategy etc..) occur on a regular basis.

Project Board: The Project Board will take corrective action as needed to ensure the project achieves the desired results. The Project Board will hold project reviews to assess the performance of the project and appraise the Annual Work Plan for the following year. In the project's final year, the Project Board will hold an end-of-project review to capture lessons learned and discuss opportunities for scaling up and to highlight project results and lessons learned with relevant audiences. This final review meeting will also discuss the findings outlined in the project terminal evaluation report and the management response.

Project Implementing Partner: The Implementing Partner is responsible for providing any and all required information and data necessary for timely, comprehensive and evidence-based project reporting, including results and financial data, as necessary and appropriate. The Implementing Partner will strive to ensure project-level M&E is undertaken by national institutes, and is aligned with national systems so that the data used by and generated by the project supports national systems.

UNDP Country Office: The UNDP Country Office will support the Project Manager as needed, including through annual supervision missions. The annual supervision missions will take place according to the schedule outlined in the annual work plan. Supervision mission reports will be circulated to the project team and Project Board within one month

of the mission. The UNDP Country Office will initiate and organize key GEF M&E activities including the annual GEF PIR, the *independent mid-term review* (MTR) and the independent terminal evaluation (TE). The UNDP Country Office will also ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality.

The UNDP Country Office is responsible for complying with all UNDP project-level M&E requirements as outlined in the UNDP POPP. This includes ensuring the UNDP Quality Assurance Assessment during implementation is undertaken annually; that annual targets at the output level are developed, and monitored and reported using UNDP corporate systems; the regular updating of the ATLAS risk log; and, the updating of the UNDP gender marker on an annual basis based on gender mainstreaming progress reported in the GEF PIR and the UNDP ROAR. Any quality concerns flagged during these M&E activities (e.g. annual GEF PIR quality assessment ratings) must be addressed by the UNDP Country Office and the Project Manager.

The UNDP Country Office will retain all M&E records for this project for up to seven years after project financial closure in order to support ex-post evaluations undertaken by the UNDP Independent Evaluation Office (IEO) and/or the GEF Independent Evaluation Office (IEO).

UNDP-GEF Unit: Additional M&E and implementation quality assurance and troubleshooting support will be provided by the UNDP-GEF Regional Technical Advisor and the UNDP-GEF Directorate as needed.

Audit: The project will be audited according to UNDP Financial Regulations and Rules and applicable audit policies on DIM implemented projects.[13]

Additional GEF monitoring and reporting requirements:

Inception Workshop and Report: A project inception workshop will be held within two months after the project document has been signed by all relevant parties to, amongst others:
a) Re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project implementation;
b) Discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms;
c) Review the results framework and finalize the indicators, means of verification and monitoring plan;
d) Discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E budget; identify national/regional institutes to be involved in project-level M&E; discuss the role of the GEF OFP in M&E;
e) Update and review responsibilities for monitoring the various project plans and strategies, including the risk log; Environmental and Social Management Plan and other safeguard requirements; the gender strategy; the knowledge management strategy, and other relevant strategies;
f) Review financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and
g) Plan and schedule Project Board meetings and finalize the first-year annual work plan.

The Project Manager will prepare the inception report no later than one month after the inception workshop. The inception report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and will be approved by the Project Board.

GEF Project Implementation Report (PIR): The Project Manager, the UNDP Country Office, and the UNDP-GEF Regional Technical Advisor will provide objective input to the annual GEF PIR covering the reporting period July (previous year) to June (current year) for each year of project implementation. The Project Manager will ensure that the

[13] See guidance here: https://info.undp.org/global/popp/frm/pages/financial-management-and-execution-modalities.aspx

indicators included in the project results framework are monitored annually in advance of the PIR submission deadline so that progress can be reported in the PIR. Any environmental and social risks and related management plans will be monitored regularly, and progress will be reported in the PIR.

The PIR submitted to the GEF will be shared with the Project Board. The UNDP Country Office will coordinate the input of the GEF Operational Focal Point and other stakeholders to the PIR as appropriate. The quality rating of the previous year's PIR will be used to inform the preparation of the subsequent PIR.

Lessons learned and knowledge generation: Results from the project will be disseminated within and beyond the project intervention area through existing information sharing networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to the project. The project will identify, analyse and share lessons learned that might be beneficial to the design and implementation of similar projects and disseminate these lessons widely. There will be continuous information exchange between this project and other projects of similar focus in the same country, region and globally.

GEF Focal Area Tracking Tools: The following GEF Tracking Tool will be used to monitor global environmental benefit results:
The baseline/CEO Endorsement GEF CCM Tracking Tool – submitted in Annex 4 to this project document – will be updated by the Project Manager/Team and shared with *the* mid-term review consultants and terminal evaluation consultants (not the evaluation consultants hired to undertake the *MTR* or the TE) before the required review/evaluation missions take place. The updated GEF Tracking Tool will be submitted to the GEF along with the completed Mid-term Review report and Terminal Evaluation report.

Independent Mid-term Review (MTR): An independent mid-term review process will begin after the second PIR has been submitted to the GEF, and the MTR report will be submitted to the GEF in the same year as the 3rd PIR. The MTR findings and responses outlined in the management response will be incorporated as recommendations for enhanced implementation during the final half of the project's duration. The terms of reference, the review process and the MTR report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Centre (ERC) website. As noted in this guidance, the evaluation will be 'independent, impartial and rigorous'. The consultants who will be recruited to undertake the assignment will be independent from organisations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-GEF Directorate. The final MTR report will be available in English and will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and approved by the Project Board.

Terminal Evaluation (TE): An independent terminal evaluation (TE) will take place upon completion of all major project outputs and activities. The terminal evaluation process will begin three months before operational closure of the project allowing the evaluation mission to proceed while the project team is still in place, yet ensuring the project is close enough to completion for the evaluation team to reach conclusions on key aspects such as project sustainability. The Project Manager will remain on contract until the TE report and management response have been finalized. The terms of reference, the evaluation process and the final TE report will follow the standard templates and guidance prepared by the UNDP IEO for GEF-financed projects available on the UNDP Evaluation Resource Centre website. As noted in this guidance, the evaluation will be 'independent, impartial and rigorous'. The consultants who will be recruited to undertake the assignment will be independent from organisations that were involved in designing, executing or advising on the project to be evaluated. The GEF Operational Focal Point and other stakeholders will be involved and consulted during the terminal evaluation process. Additional quality assurance support is available from the UNDP-GEF Directorate. The final TE report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser, and will be approved by the Project Board. The TE report will be available to the public in English on the UNDP ERC website.

The UNDP Country Office will include the planned project terminal evaluation in the UNDP Country Office evaluation plan, and will upload the final terminal evaluation report in English and the corresponding management response to the UNDP Evaluation Resource Centre (ERC). Once uploaded to the ERC, the UNDP IEO will undertake a quality assessment and validate the findings and ratings in the TE report, and rate the quality of the TE report. The UNDP IEO assessment report will be sent to the GEF IEO along with the project terminal evaluation report.

Final Report: The project's terminal PIR along with the terminal evaluation (TE) report and corresponding management response will serve as the final project report package. The final project report package shall be discussed with the Project Board during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Mandatory GEF M&E Requirements and M&E Budget:

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[14] (US$)		Time frame
		GEF grant	Co-financing	
Inception Workshop	UNDP Country Office	5,000	5,000	Within two months of project document signature
Inception Report	Project Manager	None	None	Within two weeks of inception workshop
Standard UNDP monitoring and reporting requirements as outlined in the UNDP POPP	UNDP Country Office	None	None	Quarterly, annually
Monitoring of indicators in project results framework	Project Manager	12,000	8,000	$ 4,000/year carried out annually
GEF Project Implementation Report (PIR)	Project Manager and UNDP Country Office and UNDP-GEF team	None	None	Annually
DIM Audit as per UNDP audit policies	UNDP Country Office	9,000	6,000	Annually or other frequency as per UNDP Audit policies -$ 3,000/year
Lessons learned and knowledge generation	Project Manager		3,000	Annually
Monitoring of environmental and social risks, and corresponding management plans as relevant	Project Manager UNDP CO	None	3,000	On-going
Addressing environmental and social grievances	Project Manager	None for time of project	None	

[14] Excluding project team staff time and UNDP staff time and travel expenses.

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[14] (US$)		Time frame
		GEF grant	Co-financing	
	UNDP Country Office BPPS as needed	manager, and UNDP CO		
Project Board meetings	Project Board UNDP Country Office Project Manager	None	3,000	At minimum, annually
Supervision missions	UNDP Country Office	None[15]	4,000	Annually
Oversight missions	UNDP-GEF team	None	4,000	Troubleshooting as needed
Knowledge management as outlined in Outcome 4	Project Manager	26,450	None	On-going – to be covered as part of project fees
GEF Secretariat learning missions/site visits	UNDP Country Office and Project Manager and UNDP-GEF team	None	None	To be determined.
Mid-term GEF Tracking Tool to be updated by (add name of national/regional institute if relevant)	Project Manager	10,000	5,000	Before mid-term review mission takes place.
Independent Mid-term Review (MTR) and management response	UNDP Country Office and Project team and UNDP-GEF team	25,000	5,000	Between 2nd and 3rd PIR.
Terminal GEF Tracking Tool to be updated by (add name of national/regional institute if relevant)	Project Manager	10,000	5,000	Before terminal evaluation mission takes place
Independent Terminal Evaluation (TE) included in UNDP evaluation plan, and management response	UNDP Country Office and Project team and UNDP-GEF team	40,000	5,000	At least three months before operational closure
Translation of MTR and TE reports into English	UNDP Country Office	10,000	5,000	
TOTAL indicative COST Excluding project team staff time, and UNDP staff and travel expenses		147,450	61,000	

[15] The costs of UNDP Country Office and UNDP-GEF Unit's participation and time are charged to the GEF Agency Fee.

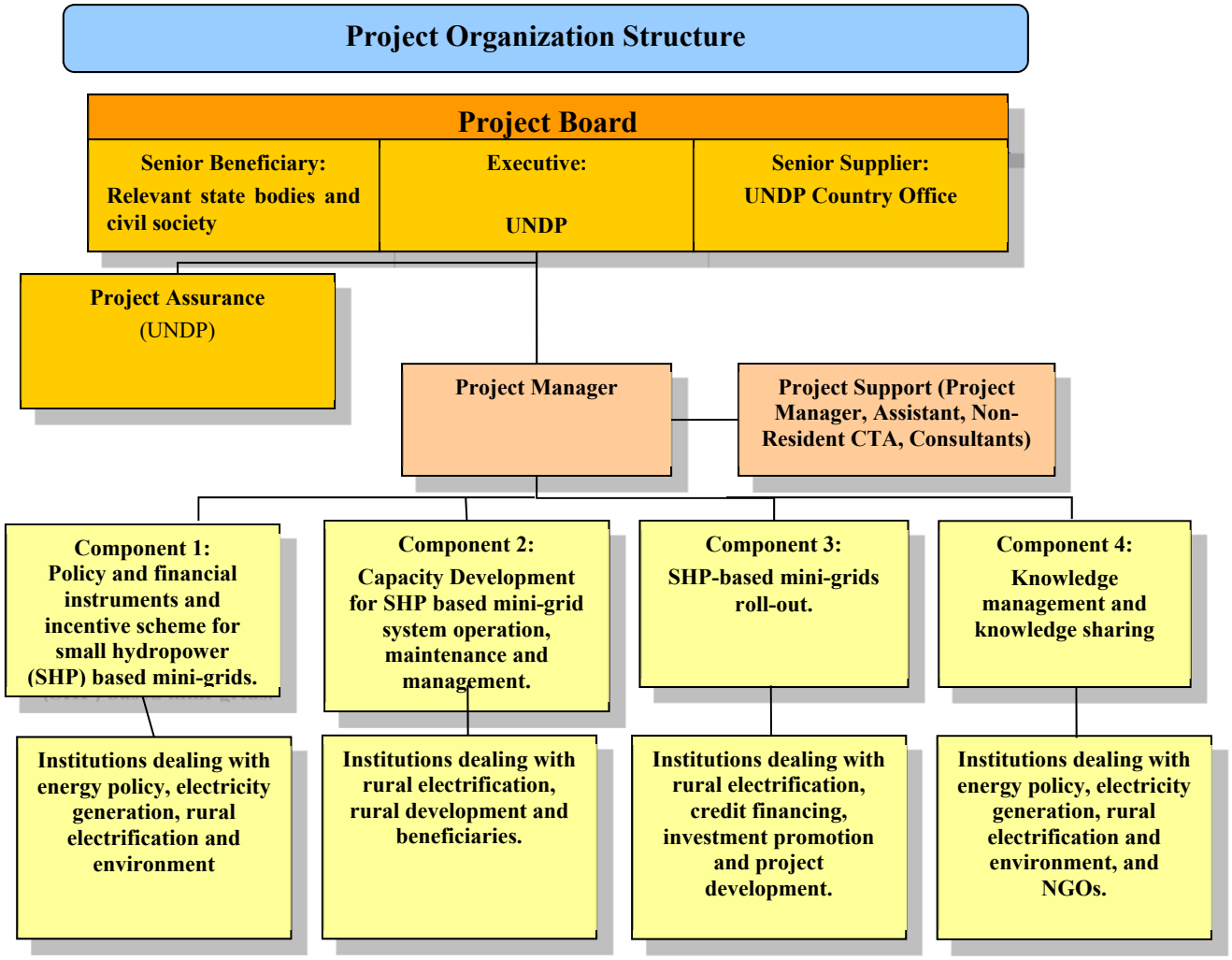
VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

The project will be implemented following UNDP's direct implementation modality (DIM), according to the Standard Basic Assistance Agreement between UNDP and the Government of Central African Republic and the Country Programme. Due to the overall security situation of the country, and the lack of sufficient capacity from Government entities, the project will be implemented through the DIM execution modality by UNDP. UNDP will carefully separate the oversight and execution functions, to provide an effective firewall avoiding double-dipping.

The **Implementing Partner** for this project is UNDP (DIM modality). The Implementing Partner is responsible and accountable for managing this project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of UNDP resources.

Under DIM arrangements, UNDP is held accountable for the disbursement of funds and the achievement of the project goals, according to the approved work plan. Working closely with the Government, and in particular the Responsible Parties, UNDP Country Office will be responsible for: (i) providing financial and audit services to the project, (ii) recruitment of project staff and contracting of consultants and service providers, (iii) overseeing financial expenditures against project budgets approved by the Project Steering Committee, (iv) appointment of independent financial auditors and evaluators; and (v) ensuring that all activities, including procurement and financial services, are carried out in strict compliance with UNDP-GEF procedures. In the context of this specific UNDP-implemented, GEF-financed project, the UNDP-GEF Staff (led by the Regional Technical Advisor) will provide an additional layer of oversight, and will participate in regular project team calls to monitor progress and oversee project implementation.

The project organisation structure is as follows:



The **Project Board** (also called Project Steering Committee) is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendation for UNDP/Implementing Partner approval of project plans and revisions. In order to ensure UNDP's ultimate accountability, Project Board decisions should be made in accordance with standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case a consensus cannot be reached within the Board, final decision shall rest with the UNDP Programme Manager. The Board will have at the minimum nine members: one representative of ARSEC, one representative of ACER, one representative of MMEH, one representative of FNGI, one representative of local banks, one representative of the private sector, one representative of civil society, one gender expert and one representative of UNDP country office. The Project Manager and his assistant participate in every board meeting. The Board specific role with regards to the financial instrument is to approve the call for proposal and select the winning bids. Members of the Board are also expected to serve as advisors to the project developers especially on how to obtain the necessary administrative authorizations (while the clearinghouse is being reinforced) and most importantly on how to access the FNGI and FAGACE loan guarantees.

The **Project Manager** will run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager will have primary responsibility over the financial instrument. Specifically, he/she will draft the call for proposal, evaluate proposals, make recommendations to the Project Board, provide ongoing financial support to the selected project developers, manage allocation of the grant, monitor the progress of the SHP and

support site developers in their fundraising efforts. The Project Manager function will end when the final project terminal evaluation report, and other documentation required by the GEF and UNDP, has been completed and submitted to UNDP (including operational closure of the project).

The **project assurance** role will be provided by the UNDP Country Office specifically

Additional quality assurance will be provided by the UNDP Regional Technical Advisor as needed.

UNDP Direct Project Services as requested by Government: This project is under DIM, UNDP will provide direct project services. The services would follow the UNDP DPC policies on GEF funded projects on the recovery of direct costs. As is determined by the GEF Council requirements, these service costs will be assigned as Project Management Cost, duly identified in the project budget as Direct Project Costs. Eligible Direct Project Costs should not be charged as a flat percentage. They should be calculated on the basis of estimated actual or transaction based costs and should be charged to the direct project costs account codes: "64397- Services to projects – CO staff" and "74596 – Services to projects – GOE for CO".

Agreement on intellectual property rights and use of logo on the project's deliverables and disclosure of information**:** In order to accord proper acknowledgement to the GEF for providing grant funding, the GEF logo will appear together with the UNDP logo on all promotional materials, other written materials like publications developed by the project, and project hardware. Any citation on publications regarding projects funded by the GEF will also accord proper acknowledgement to the GEF. Information will be disclosed in accordance with relevant policies notably the UNDP Disclosure Policy[16] and the GEF policy on public involvement[17].

Project management*:* The project will be operationalised through the use of a Project Management Unit (PMU). Key PMU management roles include:

- Lead the development of project design including preparation of consultants' and sub-contractors' terms of reference, identification and selection of national and international sub-contractors/consultants, cost estimation, time scheduling, contracting, and reporting on project activities and budget.
- Support the activities of international/national experts, potential investors and sub-contractors and provide general administrative/financial support to project activities.
- Grant management

[16] See http://www.undp.org/content/undp/en/home/operations/transparency/information_disclosurepolicy/

[17] See https://www.thegef.org/gef/policies_guidelines

IX. FINANCIAL PLANNING AND MANAGEMENT

The total cost of the project is USD 19,303,000. This is financed through a GEF grant of USD 2,645,000, USD 500,000 in cash co-financing to be administered by UNDP and USD 16,158,000 in parallel co-financing. UNDP, as the GEF Implementing Agency, is responsible for the execution of the GEF resources and the cash co-financing transferred to UNDP bank account only.

Parallel co-financing: The actual realization of project co-financing will be monitored during the mid-term review and terminal evaluation process and will be reported to the GEF. The planned parallel co-financing will be used as follows:

Co-financing Source	Co-financi type	Co-financi Amount ($	Planned Activities/Outputs	Risks	Risk Mitigation Measures
National Government	Cash	600,000	(i) Contribution towards Component 1 to jumpstart the participation of the private sector in the development of small hydropower-based mini-grids for rural electrification in the country. (ii) Contribution towards Component 2 to address technical barriers to the implementation of hydropower-based isolated mini-grids for rural electrification. (iii) Contribution towards Component 4 to support knowledge management and gender mainstreaming. (iv) Contribution for project management.	Shift in Government focus to other priorities.	On-going dialogue and partnership with authorities.
UNDP	Cash	500,000	Grant for Component 3 for SHP-based mini-grids roll-out.	Risk of reallocation of TRAC resources.	Project success will be shared with UNDP regional and global offices.
Multilateral Development/Local B	Cash	9,000,000	Credit financing for SHP-base mini-grids roll-out under Component 3.	Shift in investment priorities.	On-going dialogue and partnership.
Private Sector	Equity	6,558,000	Investment in SHP-based mini-grids roll-out under Component 3.	Shift in investment priorities.	Technical assistance provided for project development.

Budget Revision and Tolerance: As per UNDP requirements outlined in the UNDP POPP, the Project Board will agree on a budget tolerance level for each plan under the overall annual work plan allowing the project manager to expend up to the tolerance level beyond the approved project budget amount for the year without requiring a revision from the Project Board. Should the following deviations occur, the Project Manager and UNDP Country Office will seek the approval of the UNDP-GEF team as these are considered major amendments by the GEF:

a) Budget re-allocations among components in the project with amounts involving 10% of the total project grant or more;
b) Introduction of new budget items/or components that exceed 5% of original GEF allocation.

Any over expenditure incurred beyond the available GEF grant amount will be absorbed by non-GEF resources (e.g. UNDP TRAC or cash co-financing).

Refund to Donor: Should a refund of unspent funds to the GEF be necessary, this will be managed directly by the UNDP-GEF Unit in New York.

Project Closure: Project closure will be conducted as per UNDP requirements outlined in the UNDP POPP. Only on an exceptional basis, a no-cost extension beyond the initial duration of the project will be sought from in-country UNDP colleagues and then the UNDP-GEF Executive Coordinator.

Operational completion: The project will be operationally completed when the last UNDP-financed inputs have been provided and the related activities have been completed. This includes the final clearance of the Terminal Evaluation Report (that will be available in English) and the corresponding management response, and the end-of-project review Project Board meeting. The Implementing Partner through a Project Board decision will notify the UNDP Country Office when operational closure has been completed. At this time, the relevant parties will have already agreed and confirmed in writing on the arrangements for the disposal of any equipment that is still the property of UNDP.

Financial completion: The project will be financially closed when the following conditions have been met:

a) The project is operationally completed or has been cancelled;
b) The Implementing Partner has reported all financial transactions to UNDP;
c) UNDP has closed the accounts for the project;
d) UNDP and the Implementing Partner have certified a final Combined Delivery Report (which serves as final budget revision).

The project will be financially completed within 12 months of operational closure or after the date of cancellation. Between operational and financial closure, the implementing partner will identify and settle all financial obligations and prepare a final expenditure report. The UNDP Country Office will send the final signed closure documents including confirmation of final cumulative expenditure and unspent balance to the UNDP-GEF Unit for confirmation before the project will be financially closed in Atlas by the UNDP Country Office.

X. TOTAL BUDGET AND WORK PLAN

Total Budget and Work Plan			
Atlas Proposal or Award ID:	00105867	Atlas Primary Output Project ID:	00106888
Atlas Proposal or Award Title:	Project Title: Promotion of small hydropower based mini-grids for a better access to modern energy services in Central African Republic.		
Atlas Business Unit	CAF10		
Atlas Primary Output Project Title			
UNDP-GEF PIMS No.	5680		
Implementing Partner	UNDP		

GEF Outcome/ Atlas Activity	Resp. Party / Impl. Agent	Fund ID	Donor Name	ATLAS Budget Code	Atlas Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Amount Year 5 (USD)	TOTAL Amount (USD)	Notes
Component 1: Policy and financial instruments and incentive scheme for small hydropower (SHP) based mini-grids. **Outcome 1:** Institutional and financial viability of SHP mini-grid ensured.	UNDP	62000	GEF	71200	International Consultants	25,000	25,000	25,000	25,000	25,000	125,000	a
				71300	Local Consultants	10,000	10,000	15,000	10,000	15,000	60,000	b
				71600	Travel	3,000	3,000	3,000	3,000	5,000	17,000	c
				72200	Equipment and Furniture	5,000	5,000	3,000	-	-	13,000	d
				74200	Publications	3,000	3,000	3,000	3,000	3,000	15,000	e
				74500	Miscellaneous	3,000	3,000	3,000	3,000	3,000	15,000	f
				75700	Training, Workshops and Conferences	2,000	0	0	0	3,000	5,000	g
					Total Outcome 1	**51,000**	**49,000**	**52,000**	**44,000**	**54,000**	**250,000**	
Component 2: Capacity Development for SHP based mini-grid system operation, maintenance and management (O&M&M).	UNDP	62000	GEF	71200	International Consultants	30,000	30,000	20,000	20,000	20,000	120,000	h
				71300	Local Consultants	15,000	15,000	10,000	10,000	10,000	60,000	i
				71600	Travel	5,000	5,000	5,000	5,000	5,000	25,000	j
				72200	Equipment and Furniture	40,000	42,500	0	0	0	82,500	k

Outcome 2: Capacity to deliver turnkey solutions and quality O&M&M services for SHP developed.				74500	Miscellaneous	2,500	2,500	2,500	2,500	2,500	12,500	l
					Total Outcome 2	**92,500**	**95,000**	**37,500**	**37,500**	**37,500**	**300,000**	
Component 3: SHP-based mini-grids roll-out. **Outcome 3**: A functioning business model is demonstrated for the technical and financial viability of small hydro-based plants.	UNDP	62000	GEF	71200	International Consultants	75,000	75,000	75,000	60,000	60,000	345,000	m
				71300	Local Consultants	25,000	25,000	25,000	25,000	25,000	125,000	n
				71600	Travel	5,000	5,000	5,000	5,000	5,000	25,000	o
				72100	Contractual Services Companies	0	300,000	300,000	200,000	200,000	1,000,000	p
				72200	Equipment and Furniture	80,000	80,000	45,000	20,000	0	225,000	q
				74500	Miscellaneous	10,000	5,000	5,000	5,000	5,000	30,000	r
					Total Outcome 3 (GEF only)	**195,000**	**490,000**	**455,000**	**315,000**	**295,000**	**1,750,000**	
		4000	UNDP	72100	Contractual Services - Companies	0	75,000	75,000	75,000	75,000	300,000	s
					Total Outcome 3 (UNDP only)	**0**	**75000**	**75000**	**75000**	**75000**	**300,000**	
					Total Outcome 3 (GEF + UNDP)	**195,000**	**565,000**	**530,000**	**390,000**	**370,000**	**2,050,000**	
Component 4: Knowledge Management and knowledge sharing **Outcome 4:** Increased awareness about SHP potential, investment climate and gender mainstreaming	UNDP	62000	GEF	71200	International Consultants	30,000	30,000	30,000	30,000	25,000	145,000	t
				71300	Local Consultants	10,000	10,000	10,000	7,000	5,000	42,000	u
				71600	Travel	3,000	3,000	3,000	3,000	3,000	15,000	v
				74200	Publications	2,000	2,000	2,000	2,000	5,000	13,000	w
				74500	Miscellaneous	1,000	1,000	1,000	1,000	1,000	5,000	x
					Total Outcome 4	**46,000**	**46,000**	**46,000**	**43,000**	**39,000**	**220,000**	
Project Management	UNDP	62000	GEF	71400	Project Personnel	17,000	17,000	17,000	17,000	17,000	85,000	y
		62000	GEF	74100	Professional Services	3,000	3,000	3,000	3,000	3,000	15,000	z
		62000	GEF	74596	Services to Projects	5,000	5,000	5,000	5,000	5,000	25,000	aa
					GEF Total Management	**25,000**	**25,000**	**25,000**	**25,000**	**25,000**	**125,000**	

		4000	UNDP	71400	Project Personnel	40,000	40,000	40,000	40,000	40,000	200,000	y
					UNDP Total Management	**40,000**	**40,000**	**40,000**	**40,000**	**40,000**	**200,000**	
					Total Management	**65,000**	**65,000**	**65,000**	**65,000**	**65,000**	**325,000**	
SUB-TOTAL GEF						**409,500**	**705,000**	**615,500**	**464,500**	**450,500**	**2,645,000**	
SUB-TOTAL UNDP TRAC						**40,000**	**115,000**	**115,000**	**115,000**	**115,000**	**500,000**	
PROJECT TOTAL (GEF + UNDP)						**449,500**	**820,000**	**730,500**	**579,500**	**565,500**	**3,145,000**	

	Budget Notes
a	Partial costs of NR (Non-Resident) CTA and International Consultants for SHP policies and strategies.
b	Local consultancy support to NR CTA and Int. Consultants for SHP policies and strategies.
c	Domestic travel to project sites.
d	Project equipment and software.
e	Publication of policy and strategy documents, training material, etc.
f	Miscellaneous expenses.
g	Inception and end-of-project workshops.
h	Partial costs of NR CTA and Int. Consultants for capacity development.
i	Local consultancy support to NR CTA and Int. Consultants for capacity development.
j	Domestic travel to project sites.
k	Equipment and software for data input and processing.
l	Miscellaneous expenses.
m	Partial costs of NR CTA and Int. Consultants for village energisation.
n	Local consultants to support NR CTA and Int. Consultants for village energisation.
o	Domestic travel to project sites.
p	Financial support for the procurement pre-project studies and the procurement of equipment or construction.
q	Equipment and software for designing FSS and undertaking/reviewing pre-feasibility/feasibility studies.
r	Miscellaneous expenses.

	Budget Notes
s	Support for the procurement pre-project studies and the procurement of equipment or construction
t	Mid-term Review and Terminal Evaluation Int. Consultant
u	Mid-term Review and Terminal Evaluation Consultancies Local consultants
v	Domestic travel to project sites.
w	Publications of results obtained, lessons learned, etc.
x	Miscellaneous expenses.
y	Project personnel costs.
z	Project annual audit
aa	Other projects costs, related to Direct Project Costs (DPCs), described in Annex 11.

Summary of Funds

	Amount ($) Year 1	Amount ($) Year 2	Amount ($) Year 3	Amount ($) Year 4	Amount ($) Year 5	Total ($)
GEF	379,500	672,500	620,500	492,000	480,500	2,645,000
UNDP	40,000	115,000	115,000	115,000	115,000	500,000
National Government	120,000	120,000	120,000	120,000	120,000	600,000
Multilateral Development and Local Banks (through Ministry of Mines, Energy and Hydraulics)	1,500,000	2,000,000	2,000,000	2,000,000	1,500,000	9,000,000
Private Sector	600,000	1,750,000	1,750,000	1,750,000	708,000	6,558,000
TOTAL	2,639,500	4,657,500	4,610,500	4,477,000	2,918,500	19,303,000

XI. LEGAL CONTEXT

In the context of CAR, there is no signed Standard Basic Assistance Agreement (SBAA), thus Option b from the ProDoc template applies.

The project document shall be the instrument envisaged and defined in the Supplemental Provisions to the Project Document, attached hereto and forming an integral part hereof, as "the Project Document".

To ensure its responsibility for the safety and security of the UNDP personnel and property, UNDP shall: (a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried; (b) assume all risks and liabilities related to UNDP's security, and the full implementation of the security plan.

The UNDP shall undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document."

Any designations on maps or other references employed in this project document do not imply the expression of any opinion whatsoever on the part of UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

XII. MANDATORY ANNEXES

1) Multiyear Workplan
2) Monitoring Plan
3) Evaluation Plan
4) GEF Tracking Tool (s) at baseline
5) Terms of Reference for Project Manager, Chief Technical Advisor and other positions as appropriate
6) UNDP Risk Log
7) GHG Calculations
8) Potential SHP Investors
9) Levelized Cost of Electricity Analysis
10) UNDP Social and Environmental and Social Screening Template (SESP)

ANNEX 1 : MULTI-YEAR WORK PLAN

Task/Output	Responsible Party	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Component 1: Policy and financial instruments and incentive scheme for small hydropower (SHP) based mini-grids.																					
Output 1.1: Policy package to develop and operate SHP-based mini-grids adopted.	MMEH																				
Output 1.2: Financial instrument to support SHP mini-grid development, adopted and implemented	UNDP																				
Output 1.3: Tariff criteria for SHP- based mini grids defined.	MMEH																				
Output 1.4: Dedicated window at national clearinghouse/one-stop shop for SHP developers established.	MMEH																				
Component 2: Capacity Development for SHP based mini-grid system operation, maintenance and management (O&M&M).																					
Output 2.1: Published Guidebook on SHP-based mini-grid development.	MMEH																				
Output 2.2: On-the-job capacity development programme for SHP (men and women) plant developers delivered, including on plant design, construction, equipment selection, assembly and	UNDP																				

Task/Output	Responsible Party	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
O&M.																					
Output 2.3: Business and technical advisory services to mini-grid plant developers.	MMEH																				
Output 2.4: Tailored capacity development programme delivered to relevant national agencies.	UNDP																				
Component 3: SHP-based mini-grids roll-out.																					
Output 3.1: 8 sites for mini-grids identified and assessed, and institutional/investment model defined.																					
Output 3.2: At least 4 public private partnerships are established for the exploitation of SHP plants and mini-grids.																					
Output 3.3: At least 2 MW of SHP-based power generation capacity.																					
Output 3.4: At least 2 selected sustainable O&M&M model demonstrated for all mini-grid schemes.																					
Output 3.5: Productive use promoted to increase																					

Task/Output	Responsible Party	Year 1				Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
electricity demand in the 8 targeted sites.																					
Component 4: Knowledge Management and knowledge sharing																					
Output 4.1: National Plan to implement outreach/promotional activities targeting both domestic and international investors.	MMEH																				
Output 4.2: Published materials (including video) and informational meetings with stakeholders on project experience/best practices and lessons learned.	UNDP																				
Output 4.3: Dissemination of project results and lessons learned within the country and in the region.	UNDP																				
Output 4.4: Dissemination of lessons learned on mainstreaming gender in the project	UNDP																				
Project Reviews and Evaluation																					
Annual Implementation Review.	UNDP																				
Mid-Term Review.	UNDP																				
Terminal Evaluation.	UNDP																				

ANNEX 2 : MONITORING PLAN - The Project Manager will collect results data according to the following monitoring plan.

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
Project Objective: To promote investment in small hydro-power (SHP) mini-grids and develop an appropriate business model for the sustainability of the provision of rural energy services.	**Indicator 1:** Emission reduction (in tCO_2 over 25-year project equipment lifetime).	Emission reduction of 327,250 tCO_2 achieved over 25-year project equipment lifetime.	Audit reports.	End-of-project report.	UNDP CO	Project's annual reports, GHG monitoring and verification reports.	Continued commitment of project partners, including Government agencies and investors/developers.
	Indicator 2: Investment in SHP.	Almost $ 16.7 million invested in SHP stations.	Audit reports.	End-of-project report.	UNDP CO	Project terminal evaluation report.	Continued commitment of project partners, including Government agencies and investors/developers.
	Indicator 3: Capacity installed (MW) and annual energy produced (MWh) by SHP stations.	2.05 MW of SHP installed. 14,535 MWh from hydropower generated/year.	Audit reports.	End-of-project report.	UNDP CO	Project terminal evaluation report.	Continued commitment of project partners, including Government agencies and investors/developers.
	Indicator 4: Number of jobs created.	550 jobs created.	Audit reports.	End-of-project report.	UNDP CO	Project terminal evaluation report.	Continued commitment of project partners, including Government agencies and investors/developers.
	Indicator 5: Number of beneficiary households and	Over 10,000 beneficiary households and businesses have	Audit reports.	End-of-project report.	UNDP CO	Project terminal evaluation report.	Continued commitment of project partners, including Government

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
	businesses in rural areas.	access to electricity services.					agencies and investors/developers.
Outcome 1: Institutional and financial viability of SHP mini-grid ensured.	**Indicator 1:** Existence of policies and strategies.	Not available at the present time.	Completed and approved by Government within 9 months of project initiation.	Already completed and approved by Government.	Project documentation.	Commitment of Government entities.	Existence of policies and strategies.
	Sub-Indicator 1.1: Existence of policy package for SHP mini-grid development.	Policy package for SHP mini-grid development available.	Government, policy/strategy. documents and plans.	End-of-activity reporting.	UNDP CO	Project documentation.	Cooperation and interest of Government entities.
	Sub-Indicator 1.2: Existence of financial viability mechanism for SHP mini-grid development.	Financial viability mechanism for SHP mini-grid development established.	Project reports.	End-of-activity reporting.	UNDP CO	Reports on completed village energisation projects.	Continued interest of private sector investors.
	Sub-Indicator 1.3: Existence of criteria to define tariffs for SHP. Existence of approved tariffs for SHP.	Criteria to define tariffs for SHP developed. Approved tariffs for electricity supply from SHP stations.	Project reports.	End-of-activity reporting.	UNDP CO	Project reports. Project reports.	Continued interest of the private sector.

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
	Sub-Indicator 1.4: Existence of dedicated window at national clearing house/ one-stop shop.	Dedicated window at national clearing house/one-stop shop operational.	Project reports.	End-of-activity reporting.	UNDP CO	Project documentation.	Expected expansion of programme. Cooperation of Government entities and staff.
Outcome 2: Capacity to deliver turnkey solutions and quality O&M&M services for SHP developed.	**Indicator 2:** Evidence that capacity of stakeholders has been developed.	Not available at the present time.	Completed within 12 months of project initiation.	Already completed.	Project documentation.	Cooperation of all stakeholders.	Evidence that capacity of stakeholders has been developed.
	Sub-Indicator 2.1: Availability of Guidebook on SHP-based mini-grid development.	None available at the present time.	Completed within 12 months of project initiation and Guidebook validated by stakeholders by the end of Year 1.	Already completed and Guidebook validated.	Published documents.	Commitment of the various Government institutions and NGOs.	Availability of Guidebook on SHP-based mini-grid development.
	Sub-Indicator 2.2: Availability of programme for on-the-job capacity development.	Programme for on-the-job capacity development in place.	Project reports.	Annual reporting.	UNDP CO	Project reports.	Continued commitment of project developers.

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
	Sub-Indicator 2.3: Existence of efficient business and technical advisory services.	Facility for providing business and technical advisory services established.	Project reports.	End-of-activity reporting.	UNDP CO	Evidence of fully operational advisory services Unit. Project reports.	Continued commitment of the various Government institutions and project developers.
	Sub-Indicator 2.4: Evidence of capacity development programme delivered to appropriate national agencies.	Capacity development programme delivered to appropriate national agencies.	Project reports.	Annual Reporting.	UNDP CO	Project documentation.	Designation of staff by relevant Government Departments/other Institutions.
Outcome 3: A functioning business model is demonstrated for the technical and financial viability of small hydro-based plants.	**Indicator 3:** Availability of business model.	No such model available now.	Completed within 12 months of project start.	Already completed.	Project reports.	Government entities and private sector willing to cooperate.	Availability of business model.
	Sub-Indicator 3.1: Existence of completed full feasibility studies and business plans or prefeasibility studies for the 8 identified sites.	No such feasibility studies/business plans available at the present time.	Completed within 12 months of project start.	Already completed.	Project reports.	Continued interest of Government and private sector.	Existence of completed full feasibility studies and business plans or prefeasibility studies for the 8 identified sites.

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
	Sub-Indicator 3.2: Existence of fully-executed partnership documents.	Fully-executed partnership documents available.	Partnership documents.	End-of-activity reporting.	UNDP CO	Contracts confirming the setting up of partnerships.	Continued interest of Government entities and private investors.
	Sub-Indicator 3.3: Evidence of at least 2 MW of SHP generation capacity being operational.	At least 2 MW of SHP generation operational.	Completion reports.	Terminal Evaluation Report.	UNDP CO	Reports that a total of at least 2 MW of hydropower capacity has been constructed and is operational.	Continued interest of Government entities and private investors.
	Sub-Indicator 3.4: Evidence of selected sustainable model.	Sustainable model is implemented.	Annual reports.	Annual Reporting.	UNDP CO	Project documentation.	Continued interest of Government entities and private sector.
	Sub-Indicator 3.5: Evidence of productive uses of electricity.	Increased purchasing power of consumers.	Annual reports.	Annual Reporting.	UNDP CO	Project reports.	Interest and willingness of electricity consumers to embark upon income-generating activities.
Outcome 4: Knowledge management and knowledge sharing.	**Indicator 4:** Existence of public relations and investment promotion programme.	Lack of sufficient information to pursue programme.	Evidence of increased awareness among stakeholders.	Increased awareness among stakeholders in place to promote and develop SHP-	Project final report and web site.	Growth of programme will be sustained.	Existence of public relations and investment promotion programme.

Monitoring	Indicators/ Sub-Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
				based mini-grids for village energy services.			
	Sub-Indicator 4.1: Plan for public relations and investment promotion available and operationalised.	No such plan available.	Completed within 24 months of project initiation.	Already completed.	Project reports.	Designation of staff by relevant Government Departments/other Institutions.	*Plan for public relations and investment promotion available and operationalised.*
	Sub-Indicator 4.2: Existence of published material.	Material published.	End-of-activity report.	End-of-activity reporting.	UNDP CO	Project documentation and website.	Continued interest of stakeholders.
	Sub-Indicator 4.3: Existence of dissemination products and tools.	Dissemination products and tools available.	End-of-activity report.	End-of-activity reporting.	UNDP CO	Project documentation and website.	Interest of local (and international) stakeholders.
	Sub-Indicator 4.4: Dissemination of lessons learned on mainstreaming gender in the project.	Dissemination products available	End-of-activity report	End-of-activity reporting	UNDP CO	Project documentation and website	Commitment of project staff in implementing a gender inclusive project

ANNEX 3 : EVALUATION PLAN

Evaluation Title	Planned start date Month/year	Planned end date Month/year	Included in the Country Office Evaluation Plan	Budget for consultants ($)	Other budget (i.e. travel, site visits etc. - $)	Budget for translation
Mid-Term Review	June 2020	November 2020	Yes	23,000	7,000	$ 5,000
Terminal Evaluation	August 2022	January 2023	Yes	38,000	7,000	$ 5,000
			Total evaluation budget	85,000		

ANNEX 4 : TRACKING TOOL (see separate file)

ANNEX 5 : TERMS OF REFERENCE

1. Project Manager

I. Position Information	
Post title:	Project Manager (Full-time)
Office:	Project Management Unit (PMU)
Organisation:	Ministry of Mines, Energy and Hydraulics (MMEH)
Duration of Employment:	One year with possibility of extension
Duty station:	Bangui, Central African Republic

II. Duties

- Lead, manage and coordinate the day-to-day activities of the PMU to be established within MMEH, including administration, accounting, technical expertise, financial expertise and actual project implementation and reporting;
- Lead the development of project design including preparation of consultants' and sub-contractors' terms of reference, identification and selection of national and international sub-contractors/consultants, cost estimation, time scheduling, contracting, and reporting on project activities and budget;
- Manage a 1.3 million USD grant for the development of Small Hydropower Stations
- Provide ongoing financial advice to SHP project developers
- Provide support to SHP project developers for accessing finance
- Monitor and follow-up on the status of delivery by consultants, sub-contractors, etc.
- Coordinate activities of consultants including contract management, direction and supervision of field operations, logistical support, review of technical outputs/reports, measurement/assessment of project achievements and cost control;
- Assist in the design, supervision and outreach activities of the project;
- Provide technical support to policy discussions on renewable energy technologies for rural electrification in the country;
- Act as a liaison/facilitator among the various stakeholders, including the private sector, international and national partners;
- Assume responsibility for the quality and timing of project outputs;
- Establish and maintain relationships and act as the key focal point with UNDP CO to ensure that all programming, financial and administrative matters related to the project are transparently, expediently and effectively managed, in line with established UNDP Rules and Regulations.
- Undertake other management duties that contribute to the effective implementation of the project.

III. Qualifications and Experience

Education:	• Master's degree or equivalent in engineering, economics, business administration, finance, international development, social sciences, public administration or other relevant field.
Experience:	• Minimum of 5 years of experience in management, preferably in the energy field. • Proven ability to draft, edit and produce written proposals and results-focussed reports.

	• Proven experience working with Government, civil society, international organizations or donors in combination with the knowledge of economic and financial analysis, institutional, regulatory and policy frameworks. • Good knowledge of and experience on Climate Change issues, operational modalities. • Familiarity with UNDP-GEF rules, regulations and administrative procedures would be an advantage, but not a requirement. • Prior knowledge and experience of the political, social and environmental factors and issues related to energy development and climate change mitigation in African countries; • Experience in the use of computers and office software packages (MS Word, Excel, etc.)
Language Requirements:	• Excellent English and French, both written and oral.

2. Project Assistant

I. Position Information	
Post title:	Project Assistant (Full-time)
Office:	Project Management Unit (PMU)
Organisation:	Ministry of Mines, Energy and Hydraulics (MMEH)
Duration of Employment:	One year with possibility of extension
Duty station:	Bangui, Central African Republic

II. Functions

Under the overall supervision of the Project Manager, the Project Assistant will:

- Support the activities of international/national experts, potential investors and sub-contractors;
- Provide administrative support re. typing, filing, arranging visas for international experts/sub-contractors, maintaining project's financial records, etc.;
- Administer project accounting as per UNDP procedures;
- Assist the Project Manager in organising workshops, meetings of the Project Board and other events.
- Assist in procurement of goods and services;
- Draft letters of invitation and agendas for meetings of Project Board/workshops;
- Prepare background information, briefing materials, reports, etc., as required;
- Draft minutes of meetings, monitor/follow-up on actions required.

III. Qualifications and Experience

Education:

- Higher education in economics, management, accounting, finance or another related field.
- Specialized training in finance is desirable

Experience:

- 3 years of relevant administrative, accounting and financial experience at national and/or international level.
- Experience in the usage of computers and office software packages (MS Word, Excel, etc.).

• Previous experience of working for nationally executed programme (s) funded by bilateral/multilateral organisations. • Practical experience in procurement will be an asset.
Language Requirements: • Excellent English and French, both written and oral.

3. Chief Technical Adviser (Non-resident)

Post title:	Chief Technical Adviser (Non-Resident)
Office:	Project Management Unit (PMU)
Organisation:	Ministry of Mines, Energy and Hydraulics (MMEH)
Duration of Employment:	15 weeks (over a 5-year period) (15 days per year including 2 missions of 5 days each. Contract for 12 months, renewable based on satisfactory performance)
Duty station:	Home Office + Bangui, Central African Republic

II. Duties

Under the overall supervision of the Project Manager, the non-resident Chief Technical Adviser will:

- Work closely with the PM in coordinating and facilitating inputs of government agencies, partner organizations, scientific and research institutions, subcontractors, and national and international experts in a timely and effective manner;
- Provide guidance and assistance to the PM and project staff to ensure that the project activities conform to the approved project document;
- Provide guidance and assistance on the financial support and procurement activities.
- Assist the PM during the initial 2 months of the project, in the preparation of an "inception report" which will elaborate on the project Logical Framework Matrix and planned project activities, the 1st year Annual Work Plan and Budget, ToRs for key project staff, and an M&E plan;
- Assist the PMU in development of relevant ToRs and recruitment/mobilization of qualified national and international experts and organizations as needed to provide specific consultancy and engineering services;
- Assist the PMU in the development of call for proposal and selection criteria for SHP site developers
- Formulate detailed procedures for implementation of the Financial Instrument
- In close cooperation with the PMU and UNDP's Focal Point on Energy and Environment, and in consultation with the project partner organizations and stakeholders, prepare Annual Project Work Plans to be agreed upon by the Project Board (PB);
- Provide "on-the-job" technical guidance and mentoring to the PMU in order to strengthen their capacity to effectively implement the technical aspects of the project;
- Support the PM in reporting to the PB on the progress of project implementation and achievement of project results in accordance with the project's logical framework matrix;
- Support the PMU in project-related meetings, as required;
- Review reports of national and international consultants, project budget revisions, and administrative arrangements as required by UNDP-GEF procedures;
- Assist the PM in the development of a concrete Monitoring and Evaluation Plan at the outset of the project (within inception report);
- Support the PM in preparing project progress reports, information releases, as well as monitoring and review reports in accordance with UNDP-GEF monitoring and evaluation rules and procedures;

• Support the PM in the preparation and implementation of mid-term review and terminal Independent Evaluation Missions (TOR's, identification and recruitment of appropriate candidates, organization of missions, joint field missions and discussion with evaluators, etc.); • Support UNDP CO staff on their annual monitoring visits to project sites.	
III. Qualifications and Experience	
Education:	• Postgraduate degree in energy/renewable energy development or in finance with energy background.
Experience:	• Minimum ten years of experience in implementing renewable energy projects in combination with knowledge of economic and financial analysis, institutional, regulatory and policy frameworks; • Good knowledge of and experience GEF Climate Change issues, operational modalities; • Familiarity with UNDP-GEF rules, regulations and administrative procedures would be an advantage, but not a requirement; • Prior knowledge and experience of the political, social and environmental factors and issues related to energy development and climate change mitigation in African Developing States; • Computer proficiency, especially related to professional office software packages; • Excellent drafting and communication skills.
Language Requirements:	• Excellent English and French, both oral and written.

ANNEX 6 : UNDP RISK LOG (see Risk table of this ProDoc)

ANNEX 7 : GHG CALCULATIONS

The project is expected to be approved in time to commence activities in early 2018. Under this scenario, activities addressing the policy, regulatory and institutional issues should be completed within 12 months, i.e. by December 2018, including fully established procedures for determining tariffs (MMEH allows for differentiated tariffs in different parts of the country, based on the local cost of electricity generation) and signed PPP partnerships. Then, priority will be given to the power stations at Mbecko (to supply Mbaiki), Gbassen (to supply Boda) and Baidou (Bac) (to supply Bambari) in view of existing feasibility sites, albeit old, for these sites, thus necessitating relatively smaller capital investments for updating them, with the power station at Baidou (Bac) being the last one to come on line. In addition, it is also assumed that while the start of activities regarding the construction of the 4 small hydropower stations will be staggered, the actual construction works may run concurrently; thus, there will be no need to await completion of one hydropower plant before construction on the next one can start.

Accordingly, it is assumed that Mbecko 600-kW SHP will come on line in July 2019, i.e. 18 months after project initiation, followed by Gbassen (550 kW) coming on line in November 2019, Gamboula (300 kW additional to existing

120 kW) in March 2020 and, finally, Baidou (Bac - 600 kW) in July 2020. Hence, by July 2020, all 4 small hydropower plants would be fully operational.

Table 10: Electricity generation from small hydropower plants installed under project.

Site / Year	Mbecko, (MWh)-operational from July 2019	Gbassen, (MWh)-operational from Nov 2019	Gamboula, (MWh)-operational from March 2020	Baidou, (MWh)-operational from July 2020	Total/year (MWh)
2018	-	-	-	-	
2019	1,710	510	-	-	2,220
2020	3,760	3,140	1,380	1,710	9,990
2021	4,135	3,450	1,880	3,760	13,225
2022	4,550	3,780	2,070	4,135	14,535
Total/Site	14,155	10,880	5,330	9,605	
Grand Total					**39,770**

As per the construction completion schedule described above, electricity generation will be 2,220 MWh during Year 2 of the project (Table 10) and, respectively, 9.990 MWh, 13,225 MWH and 14,535 MWh during Years 3, 4 and 5 of the project. Thus, by project completion, some 39,770 MWh would have been generated and an annual generation of 14,535 MWh will be sustained over an expected 25-year projected life of the equipment. All this hydro generation, if not implemented, would have otherwise been accomplished through thermal power stations burning imported diesel fuel, with an emission factor of 0.875 tCO_2/MWh (Ref. Second National Communication to UNFCCC). Consequently, during the 5-year project period, almost 35,000 tonnes of CO_2 would have been avoided as a direct result of hydropower electricity generation. Furthermore, these 4 small hydropower plants will continue avoiding almost 13,000 tonnes of CO_2 annually during their remaining 21-23 years of project life. When one looks at the 25-year lifetime of the hydropower stations earmarked for development during the 5-year project period, the power stations would have generated 374,000 MWh, thus avoiding 327,250 tonnes of CO_2; this is equivalent to $ 7.7 of GEF funds per tCO_2.

Finally, under the assumption of the interest generated in small hydropower-based mini-grids during project implementation and given the conducive environment for investment that the project would have created, the estimated total replication potential of small hydropower plants in the Central African Republic with the participation of private sector investors (estimated at 40 MW over the next 10 years of "project influence", in view of the 2,000 MW hydropower potential of the country) is several times greater than what will be achieved during the five-year project implementation. Thus, the consequential post-project emission reduction estimates related to only the additional capacity amounting to 35 MW – on the basis of a conservative policy scenario and a GEF causality factor of 80% (top-down approach) -- can be computed at 4,550,000 tons of CO_2 avoided, which translates into an abatement cost of $ 0.52 of GEF funds per tCO_2 avoided. In the case of the bottom-up approach, with a replication factor of 3 (in view of the market transformation potential and associated capacity development), the consequential post-project emission avoided are computed to be 780,000 tons of CO_2.

Table 11: Project GHG emission reduction impacts

Time-frame	Direct project without replication (25-year equipment projected life).	Consequential post-project (top-down) with replication over next 10 years of project influence).	Consequential post-project (bottom-up)
Total CO_2 emissions reduced (tonnes)	327,250	4,550,000	780,000
Unit abatement cost ($/tonne CO_2)	7.7	0.52	3.23

ANNEX 8 : POTENTIAL SHP INVESTORS IN CENTRAL AFRICAN REPUBLIC

1. DAMECA SA: A Bangui-based company with an annual turn-over of approx. $ 7 million, active in the construction and maintenance of industrial parks and buildings, general trade and representation of foreign entities in CAR.
It is heavily involved in the sale of transport equipment and materials for electricity distribution. It recently completed a PV-based public lighting project in Bangui and has plans to extend its activities to electricity generation from small hydropower in the near future.
Contact: M. Yvon Kamach, Bangui.

2. SOCIETE D'ADDUCTION D'EAU ET D'ELECTRIFICATION RURALE « SAEER » SARL
Main activities: Drilling, dam construction, supply and installation of equipment for hydropower generation, civil engineering works, waste-water management, plumbing, electricity and water distribution in rural areas. Import-
It is heavily involved in drilling for water supply in Bangui and Douala (Cameroon) and recently committed itself to the construction of a central PV station to supply electricity to the town of Bouar in CAR. It has strong interests to participate in rural electrification activities in CAR from small hydropower generation.
Contacts: Messrs. Alfred Polocko-Taïnga and Désiré Malibangar, Bangui.

3. AKUO ENERGY (Headquarters in Paris, France)
As at end-2016, this French company had a total of 560 MW of generation capacity either in operation or under construction, including 2 MW of hydropower. With an annual turn-over of 149 M€ exclusively from the sale of renewable (green) energy, it is the top independent electricity producer from renewable energy in France.
Akuo Energy's activities go beyond electricity generation in that it endeavours to empower consumers in the use of electricity services for income-generating activities, e.g. processing and storage of agricultural products. It is active in 11 countries, including Croatia, Indonesia, Morocco and Turkey.
Contact: M. Benoit Galland, Paris, France.

4. SOCIETE ENERGIE SOLAIRE PV « ENR SOL PV »
Main activities: Studies, construction, commercialization, distribution and management of all aspects of improved village water supply and renewable energy, including solar PV for autonomous electricity generation for business and individual use, e.g. PV electricity generation at the Catholic Mission in the town of Bossangoa in CAR.

It plans to extend its activities to other renewable sources of energy to include small hydropower generation in partnership with Société Energies Renouvelables et Hydraulique Centrafricaine (Renewable Energy and Hydraulics Company, CAR) « SERH-CA » SARL.
Contacts: Messrs. Aimé Fructueux Mackpayen et Théodore Mackpayen, Bangui.

5. CENTRAFRIQUE GLOBAL BUSINESS CONSULTING Surl (Sole Proprietor Limited Liability Company)
This company signed a Protocol Agreement with the Ministry of Mines, Energy and Hydraulics on 5 August 2016 to build a small hydropower station at the Mbecko site. Since then, there does not seem to have been any progress regarding the development of this site for the construction of a small hydropower station.
Contact: M. Jean-Olivier Constantin Mbathas, Bangui.

ANNEX 9 : LEVELIZED COST OF ELECTRICITY FROM DIFFERENT ENERGY SOURCES in CAR

Hydropower is considered the most promising source of renewable energy in the Central African Republic, followed by solar energy and biomass. Thermal power, using diesel fuel, although the second-most used source of electricity is not financially viable in the long term as CAR is a net importer of petroleum products.

Globally, hydropower is considered one of the most cost competitive source of electricity with a levelized cost of energy (LCOE) as low as USD 0.02 compared to USD 0.06 and USD 0.14 for wind and solar respectively[18]. In CAR specifically, our LCOE calculation for hydro, solar, biomass and diesel confirms this fact.

Methodology

The LCOE calculation is based on the ratio of discounted lifetime cost and discounted lifetime generation as used by IRENA in its renewable cost analysis series. Externalities such as CO2 emissions and health impacts are excluded and even though the Decentralized Energy Policy and Strategy under development will seek an exemptions of import duties on renewable energy technologies, these incentives are not included in the calculation.

For ease of comparison, the same parameters are considered for each technology. They include installed capital cost, capacity factor, economic life, O&M cost, fuel cost and cost of capital. When available, national data provided by ENERCA (the national electricity utility) and data from feasibility studies done within the country are used. In the absence of national data, data from various sources are used including IRENA's "Renewable Energy Technologies: Cost Analysis Series" and "Lazard's Levelized Cost of Energy Analysis-version 10".

The formula used for the calculation is

$$LCOE = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + C_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

[18] IRENA (2014), "Renewable Power Generation Costs in 2014)

Where:

LCOE= the average lifetime levelized cost of electricity generation;

It= investment expenditures in year t;

Mt= operations and maintenance expenditures in year t;

Ct = cost of capital in year t;

Ft = fuel expenditures in year t;

Et= electricity generation in year t;

r= discount rate; and

n= economic life of the system

General Assumptions

A hypothetical 1MW mini-grid power plant is assumed for each technology. We also assume that the electricity generated will be distributed through an existing ENERCA diesel mini-grid that is no longer operating. For this reason, only the cost of the transmission line from the power plant to the distribution network is considered. The distance between the power plant and the distribution network is the same for all technologies except for hydro plant since the water source is generally far from the intended electrified community.

Assumptions and source of data for each variable of the LCOE equation

Investment expenditures

The key components of investment expenditures are: 1) feasibility studies; 2) environmental assessment; 3) installed capital cost and 4) transmission lines.

Feasibility studies and environmental assessments are expected to be costlier for hydroelectricity than for other electricity generation because of the potential impact on water resources and aquatic life. Local data on the cost of feasibility studies and environmental assessment are not readily available however, Centrafic Global Business Consulting, a project developer that is planning to develop the site of Mbecko uses an estimate of $200,000 in its financial projections. This value is assigned for hydro and half of that for the other technologies.

Installed capital cost is estimated for both the plant and the transmission lines. The plant includes all equipment and installation of the equipment. It is generally expressed in USD per kW while transmission lines are expressed in USD per km. For hydro, solar PV and diesel we use the equipment and installation cost from ENERCA's investment projections for 2016 to 2030. For biomass, we use data from IRENA cost analysis series as local data was not readily available. The biomass technology considered in here is direct combustion of agricultural waste or wood waste which is used to fire a boiler that produces steam which, in turn, is expanded through a steam engine to produce electricity. This is the most common form of biomass power generation in the world and is currently used in Central African Republic by a sugar factory and wood processing plants.

A transmission line will link the power plant to an existing distribution network. The length of the line is estimated at 3 km for the hydro power plant and 0.5 for the other technologies as mentioned in the general assumptions. The cost per km used is taken from a quote provided by ENERCA to Medecins Sans Frontières for the electrification of a hospital. The cost of around $47,000/km is 4 times higher than costs found the literature. For instance, in the Alliance for Rural Electrification Report "Hybrid mini-grid for rural electrification: lessons learned" the cost of transmission lines in Mali are a little over $19,000/km.

Operation and maintenance expenditures

These costs refer to fixed and variable costs. Fixed costs are generally expressed as a percentage of installed capital cost. They include labor, scheduled maintenance, replacement of mechanical and electrical equipment, batteries of and electronic component (for solar PV). Variable costs depend on the output. For biomass plant for instance, variable cost would cover ash removal, unplanned maintenance and non-biomass fuel. For our calculation, O&M cost are combined as they are not always disaggregated in the available literature. Values for hydropower and diesel generators were obtained from ENERCA while that of solar and biomass were taken from Lazard's LCOE report and IRENA respectively.

Cost of capital

We estimate that the power plant, regardless of the technology chosen, will require outside investment, typically a loan from a bank. The cost of capital is the interest that the project owner will pay annually on that loan. According to bank managers interviewed during field visit in Bangui, the typical bank loan requires a 20% co-financing from the borrower (of the total investment amount) and carries an interest rate of about 15%. The loan has a maturity of 10 years with a grace period on principal not to exceed two years. These loan conditions are used to calculate the cost of capital for each technology.

Fuel expenditures

Fuel expenditures are estimated for the biomass power plant and the diesel power plant. With regards to biomass, there is no national data on the price of biomass in RCA (wood residue or agriculture residue). The few companies that use biomass power, produce they own feedstock as a by-product of their activity. As the result, we use data from IRENA cost analysis series for biomass. For diesel, we take values from ENERCA's 2014 energy production and sales statistics which calculate an average cost of \$0.31/kWh[19].

Electricity generation

Electricity generation is calculated based on installed capacity (1 MW), capacity factor of the respective technology and the number of hours per year (8,760 hours). The capacity factor of a power plant is the ratio of its actual output over its potential output if it were to operate at full capacity. It is a key driver of electricity generation and of LCOE. ENERCA provides a capacity factor of 1 for hydropower and the capacity factor of 0.38 for diesel generation. For this paper however, we discount the capacity of hydropower by 20% to account for scheduled maintenance and potential seasonal variation of the water level. For solar PV, we adopt the capacity factor of 0.15[20] as used in a recent feasibility study by Hydrochina for a 50 MW power plant in RCA. This value is consistent with the range of 0.10 and 0.25 typically used for solar PV[21]. For biomass, we use the value of 0.85 as provided by IRENA.

Discount rate

Discount rate and cost of capital are closely linked as they are both driven by the interest rate charged by the lender. In more sophisticated investments where different instruments are combined (loan, equity, convertible debt, etc.) the discount rate would be the weighted average cost of capital where each portion of the investment is weighted for the return it is expected to generate. For this paper however we assume that there is one source of investment and that the investment is a straight debt. The discount rate is therefore the interest of 15% obtained from discussions with local bank managers.

[19] Calculation made by author from ENERCA data.

[20] Calculation made by author from Hydrochina's feasibility study

[21] http://sunmetrix.com/what-is-capacity-factor-and-how-does-solar-energy-compare/ (accessed February 6, 2017)

Economic life of the system

This variable weighs heavily on the LCOE as it amortizes the up-front capital investment over the lifetime of the technology. According to IRENA the typical economic lifetime of a small hydro plant is 40 years and that of a biomass-fired power plant is 25 years. Lazard's LCOE report estimates the economic lifetime of solar PV plants and diesel reciprocating engine plants at 30 years and 20 years respectively. These values are used in the calculations.

Table 1: Summary of assumptions for key LCOE variables

Parameters/Technology	Hydro	Solar PV	Biomass	Diesel
Installed Capital Cost ($/kW)	4,500.00	6,000.00	4,260.00	1,500.00
O&M Cost ($/kW/year)	62.00	20.00	127.80	180.00
Fuel Cost ($/kWh)	0	0	0.01	0.31
Discount/interest rate (%)	15	15	15	15
Capacity Factor (fraction)	0.8	0.15	0.85	0.38
Economic lifetime (years)	40	30	25	20

Results

Our calculation shows that in Central African Republic, a 1MW decentralized mini-grid power plant is most competitive when run on hydropower. The LCOE for this technology stands at $0.04/kWh compared to $0.07/kWh for biomass, $0.27/kWh for solar PV and $0.40/kWh for diesel.

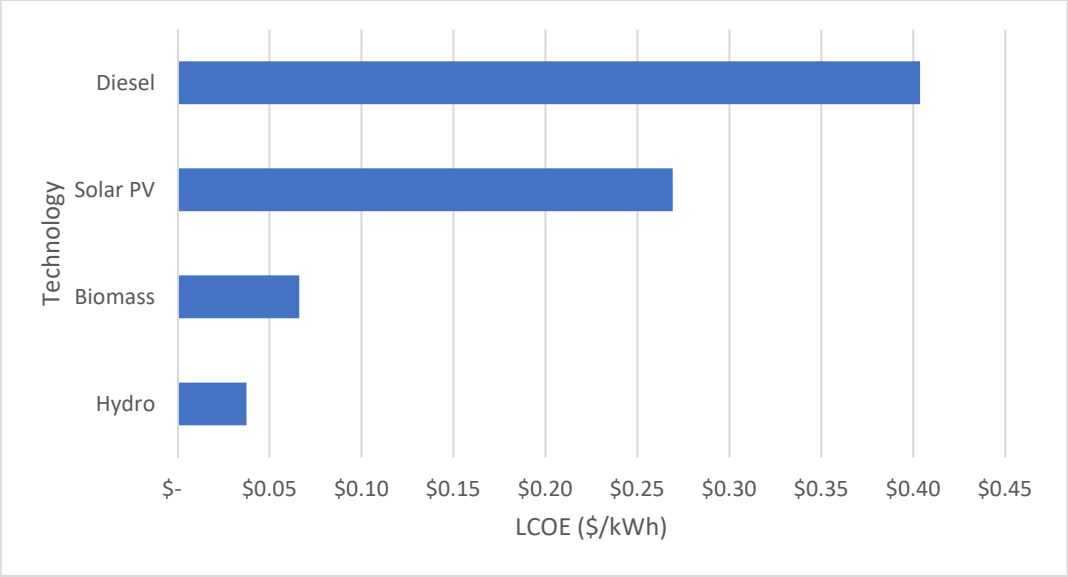


Figure 1: LCOE by technology

The LCOE calculation uses national data when available. As a reality check, we compare the results of our calculation with those published in the IRENA energy cost series and in Lazard's Levelized Cost of Energy Analysis (version 10). The comparison shows that, except for diesel, our results fit in the range of LCOE reported by IRENA and Lazard. The high LCOE of diesel in our results can be justified by the fact that

ENERCA data is based on statistics from its current installations which many decades old and very inefficient.

Table 2: LCOE comparison

	LCOE from own calculation ($/kWh)	LCOE from IRENA ($/kWh)	LCOE from Lazard ($/kWh)
Hydro	0.04	0.02 - 0.27	NA
Biomass	0.07	0.06 - 0.21	0.07 - 0.11
Solar PV	0.27	0.36 - 0.71	0.04 - 0.22
Diesel	0.40	NA	0.21 - 0.28

ANNEX 10 : SOCIAL AND ENVIRONMENTAL SCREENING TEMPLATE

The completed template, which constitutes the Social and Environmental Screening Report, must be included as an annex to the Project Document. Please refer to the Social and Environmental Screening Procedure and Toolkit for guidance on how to answer the 6 questions.

Project Information

Project Information	
1. Project Title	**Promotion of small hydropower based mini-grids for a better access to modern energy services in Central African Republic.**
2. Project Number	PIMS 5680; Atlas Award ID 00105867
3. Location (Global/Region/Country)	Central African Republic

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles in order to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
The project fully endorses the human rights-based approach and will not lead to any adverse impacts on enjoyment of human rights (civil, political, economic, environmental, social or cultural) of any key or potential stakeholders, communities involved or the population at large. **The project will focus on the provision of decentralized modern energy services to the rural population and, in the process, demonstrate the benefits that hydropower technology can provide to improve livelihoods in the rural areas. These relate to social and economic benefits in the villages in terms of a healthier environment for the rural population, opportunities for income-generating activities and improved natural resource management. In addition, the utilisation of hydropower for the provision of these services, in lieu of imported fossil fuel, will reduce the country's GHG emissions and contribute to a safer environment for the rural population.**
Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment
Gender is an important aspect of national plans as women and men have different access to resources and opportunities and are affected differently by energy programmes and policies. The aim of gender mainstreaming is to ensure that the needs of both women and men are taken into account. Gender experts will be included in implementation and coordination mechanisms and stakeholder consultations will

purposefully include women and men. As part of the national action planning process for small hydropower-based mini-grids for rural electrification), the project will encourage capacity development activities to be undertaken on gender analysis and mainstreaming tools.

Moreover, baseline data collection under the PPG already took into consideration gender-disaggregated baseline information and this will continue during implementation of Component targeting capacity development for O&M&M and income-generating activities. Gender sensitive indicators, including gender-disaggregated data, will form part of a monitoring framework to evaluate gender outcomes and the effectiveness of gender mainstreaming efforts.

Briefly describe in the space below how the Project mainstreams environmental sustainability

CAR will draw upon all their strategies for addressing climate change to systematically mainstream climate change considerations in small hydropower development. This will aid decision-making on energy infrastructure and service delivery options to take into account the uncertainty associated with climate change predictions and to assess the climate resilience of different options. For instance, decisions to invest in hydropower should take into account possible changes in the hydrology regime (including possible changes in precipitation patterns, increased demand for irrigation, and associated energy inputs). The project will ensure that the agencies tasked with the country's climate change portfolio are actively engaged in the project coordination mechanism so as to promote an integrated approach.

The project will have a direct positive effect on environmental sustainability, as the primary objective of the project is to accelerate utilisation of small hydropower technology for the global good of the rural population. This will be beneficial to both the country's economy and to the global environment, through the reduction of greenhouse gas emissions.

The estimated direct total reduction of CO_2 emissions resulting from project activities without replication is estimated at 327,000 tonnes, while the estimated post-project CO_2 emissions reduction with replication over the next 10 years of project influence is estimated at 4,550,000 tonnes.

Part B. Identifying and Managing Social and Environmental Risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low Risk Projects.*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	***Impact and Probability (1-5)***	***Significance (Low, Moderate, High)***	***Comments***	***Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.***
Risk 1: Environmental/Climate Change: Climate change can cause increased variability in CAR's hydrological regime and precipitation patterns which may pose challenges to SHP development that can affect energy planning and infrastructure investments.	I = 3 P = 3	Moderate	Environmental Risk	These risks are being and will continue to be addressed through capacity development of Government staff on the key aspects to address national challenges associated with weather, climate and climate change.
Risk 2: Land degradation: The building of roads for transportation of SHP equipment and construction of the SHP with medium voltage transmission line to load centre will necessitate clearance of forest that, if	I = 3 P = 3	Moderate	Environmental Risk	This risk will be managed through ensuring that SHP developers re-forest those locations that had to be cleared during construction, but that do not require to remain cleared once construction has been completed. Moreover, SHP developers will be required to ensure that no deforestation creeps into

not addressed, can lead to soil erosion/land degradation at these locations.				their area of operations and, in case it happens, they will need to take immediate action to remedy the situation.
Risk 3: The Project can potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	I=3 P=3	Moderate	Environmental and Social Risks	During construction of the power stations, there may be some temporary loss of habitats related to the construction of the pressure conduit from the river intake, the machine room and distribution line to the villages. However, construction works are not expected to cause any major damage and the "disturbed" habitats would normally get restored within less than 2 years after completion of construction works.
Risk 4: Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area?	I-3 P=3	Moderate	Environmental and Social Risks	There will be felling of trees related to the construction works, but re-forestation activities will be implemented upon completion of construction works. In addition, the project sites are located far from existing villages; hence, there will be no relocation of inhabitants (no indigenous people located within the project boundaries, including project sites and catchment area around these sites). However, there may be some encroachment during construction on land utilised for banana and tapioca (manioc) plantations, but most of such land can be restored for farming once construction has been completed
Risk 5: Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	I=3 P=3	Moderate	Environmental Risk	The project itself will not cause much of a negative impact on the surrounding environment, but extension of mining activities in the catchment areas can lead to a reduction of the forest cover. This, in turn, can lead to a reduction in rainfall and a subsequent reduction of the amount of water available for electricity generation.
Risk 6: Does the Project involve large-scale infrastructure	I=3 P=3	Moderate	Environmental Risk	There will be no dams constructed. Upstream from the power stations, simple weirs will be constructed to divert some of the water into a pressurised conduit

development (e.g. dams, roads, buildings)?				leading to the turbines and water exiting these turbines will flow back to the river downstream. However, a machine room will be constructed to house the equipment and a house for a watchman. Dirt roads to the project sites already exist, except that they will experience heavier traffic while construction is on-going.
Risk 7: Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?	I=2 P=2	Low	Environmental Risk	The project will not lead to any increased vulnerabilities. The one small possibility would be if the pressure conduit were to burst in case of a "water hammer". However, this is unlikely to occur as a surge tank to absorb any increased water pressure in the conduit will be built between the intake and the turbines.
Risk 8: Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	I=3 P=3		Environmental Risk	Waste will be generated in terms of used lubrication and transformer oil, but these will be disposed of in special containers and carted away for recycling.

	QUESTION 4: What is the overall Project risk categorization?		
	Select one (see SESP for guidance)		**Comments**
	Low Risk	☐	
	Moderate Risk	☒	Run-of the river small hydropower stations do not present any major risks to the environment nor create the possibility of flooding downstream as no dam is built. However, they do present some environmental challenges during construction, but these get mostly reversed within a couple of years after completion has been completed. Finally, there is no substantial diversion of the water stream that could negatively affect villagers/farmers downstream, who rely on this water for their own consumption and livelihoods.

	High Risk	☐	
	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	☐	
	Principle 2: Gender Equality and Women's Empowerment	☐	
	1. Biodiversity Conservation and Natural Resource Management	☐	
	2. Climate Change Mitigation and Adaptation	☒	The project and expansion of activities that will result in view of the experienced gained and lessons learned will substantially reduce GHG emissions that would have otherwise been emitted if diesel generators were instead used to produce and supply electricity to the rural areas.
	3. Community Health, Safety and Working Conditions	☐	
	4. Cultural Heritage	☐	
	5. Displacement and Resettlement	☐	
	6. Indigenous Peoples	☐	
	7. Pollution Prevention and Resource Efficiency	☒	Operation of hydropower stations hardly creates any noise pollution. In addition, there are no villages close to the sites nor it is expected that there will be any in the future, as these sites are pretty remote. In addition, it is efficient use of a locally-available and non-polluting resource that eliminates the need for imported fossil fuel.

Final Sign Off

Signature	*Date*	*Description*
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD), Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.
PAC Chair		UNDP chair of the PAC. In some cases, PAC Chair may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1. Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks		
Principles 1: Human Rights		**Answer (Yes/ No)**
1.	Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	**No**
2.	Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [22]	**No**
3.	Could the Project potentially restrict availability, quality of and access to resources or basic services, in particular to marginalized individuals or groups?	**No**
4.	Is there a likelihood that the Project would exclude any potentially affected stakeholders, in particular marginalized groups, from fully participating in decisions that may affect them?	**No**
5.	Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	**No**
6.	Is there a risk that rights-holders do not have the capacity to claim their rights?	**No**
7.	Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	**No**
8.	Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	**No**
Principle 2: Gender Equality and Women's Empowerment		
1.	Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	**No**
2.	Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	**No**
3.	Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	**No**
4.	Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and positions of women and men in accessing environmental goods and services?	**No**

[22] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

	For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their livelihoods and well being	
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below		
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management		
1.1	Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	**Yes**
1.2	Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	**No**
1.3	Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	**No**
1.4	Would Project activities pose risks to endangered species?	**No**
1.5	Would the Project pose a risk of introducing invasive alien species?	**No**
1.6	Does the Project involve harvesting of natural forests, plantation development, or reforestation?	**No**
1.7	Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	**No**
1.8	Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	**No**
1.9	Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	**No**
1.10	Would the Project generate potential adverse transboundary or global environmental concerns?	**No**
1.11	Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar*	**Yes**

	developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.	
Standard 2: Climate Change Mitigation and Adaptation		
2.1	Will the proposed Project result in significant[23] greenhouse gas emissions or may exacerbate climate change?	**No**
2.2	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	**Yes**
2.3	Is the proposed Project likely to directly or indirect increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	**No**
Standard 3: Community Health, Safety and Working Conditions		
3.1	Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	**No**
3.2	Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	**No**
3.3	Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	**Yes**
3.4	Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	**No**
3.5	Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?	**Yes**
3.6	Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	**No**
3.7	Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?	**No**
3.8	Does the Project involve support for employment or livelihoods that may fail to comply with national and international labour standards (i.e. principles and standards of ILO fundamental conventions)?	**No**
3.9	Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	**No**

[23] In regards to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

Standard 4: Cultural Heritage		
4.1	Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect and conserve Cultural Heritage may also have inadvertent adverse impacts)	**No**
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	**No**
Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	**No**
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	**No**
5.3	Is there a risk that the Project would lead to forced evictions?[24]	**No**
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community based property rights/customary rights to land, territories and/or resources?	**No**
Standard 6: Indigenous Peoples		
6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	**No**
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	**No**
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	**No**
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	**No**
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	**No**

[24] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a particular dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	**No**
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	**No**
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	**No**
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through the commercialization or use of their traditional knowledge and practices?	**No**
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or transboundary impacts?	**No**
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	**Yes**
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	**No**
7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	**No**
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	**No**

ANNEX 11 : DPC CALCULATION

DPC Calculation sheet (as per UNDP 2017 UPL) - Central African Republic				
Service provided	**Unit cost**	**Nb of units**	**Total**	**Notes**
Payment process	43.19	10	431.90	Applied to suppliers
Staff selection and recruitment	1333.84	4	5,335.36	for PMU staff (PM, Finance and Admin, driver, and M & E Officer)
Consultant recruitment	486.99	12	5,843.88	International and Local consultants throughout the project period
Procurement involving local CAP	1042.95	9	9,386.55	Companies hired to support policy design, enact and enforcement/ Companies hired to support the technology and services supply chain/Companies hired to support the MHP-based mini-grids investments
Procurement not involving local CAP	259.67	9	2,337.03	For purchase of equipment / publications
Check issuance	16.62	10	166.20	
Travel authorization	49.2	10	492.00	International/domestic travel to project sites, DSA payment
F10 Claim	46.33	9	416.97	
Vendor Creation	42.76	14	598.64	
Total			**25,008.53**	Total DPC for the entire project period