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Project Document

United Nations Development Programme Democratic Republic of Congo

Project Title:	Promotion of mini- and micro-hydropower plants in DRC
UNDAF Outcome:	Axis 4: Sustainable Natural Resources Management & Climate Change Outcome 5: The Congolese State improves the management of its natural resources (mining, energy, biodiversity and land) and the associated benefits, the management mechanisms, and the country is engaged towards the greening of its economy
UNDP Strategic Plan (2014-2017):	Outcome SP1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded Output 5.1: Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy)
CPAP Outputs	2.1: Policies and Programmes are better oriented at national and provincial levels and values chains are developed to create jobs; 3.2: DRC is engages into a green economy
Implementing Partners:	Ministry of Energy and Hydraulic Resources (<i>Ministère de l’Energie et des Ressources Hydrauliques/MERH</i>) Ministry of Environment and Sustainable Development (<i>Ministère de l’Environnement et du Développement Durable/MEDD</i>)

Brief Description of the Project

The overall goal of the project is to support the Government’s strategy to mitigate climate change and to go towards a green economy and to contribute to the development of electricity generation in off-grid areas in DRC, with the implementation of small scale hydropower systems.

The project will participate to DRC’s engagement in the initiative “Sustainable Energy for All” (SE4ALL) and in providing energy services in villages. The project interventions are articulated around four key issues.

The first intervention concerns the development of policies and the strengthening of the regulatory and institutional framework to promote private and community-based investment in the development and operation of small-scale hydropower systems. It includes identifying legal and political barriers to the development of micro- and mini-hydropower plants; participating to the necessary corrective actions (policies, strategies & regulations) and ensuring their implementation; helping the energy sector to develop a legal, regulatory and institutional framework specific to micro- and mini-hydropower; and assisting the industry to develop a pricing system that allows to guarantee power supply in rural areas in the long-term.

The objective of the second intervention is to create a critical mass in terms of skills and expertise targeting the technological supply chain. It will strengthen the technical capacity at national, provincial and community levels, and across the hydropower technology supply chain, by identifying and overcoming the barriers to the development of mini- and micro-hydropower plants (MHPP) in DRC. This will require assisting local manufacturers of MHPP-related equipments such as turbines; supporting local community initiatives and existing MHPP operators in rural areas; supporting the new private investors in developing solid business plans to raise additional financing; providing technical courses for the training of targeted practitioners (technicians and others) and assist in the acquisition of technical equipment necessary for learning and internships to support the development of the hydropower sector.

The third intervention will focus on several targeted investments as pilot projects within a wider selection of potential small-scale hydropower stations in rural communities. The project will hence support the development in rural areas of numerous MHPP for a total installed capacity of 10 MW by 2017. It will identify the sites following the basic information contained in the existing literature (diagnosis and the Renewable Energy Atlas) taking into account that the identified sites are viable (socially, economically and environmentally speaking). The project will facilitate the mobilization of co-financing necessary for the development of the selected sites. With this intervention, the project will generate incomes and activities such as agricultural and other processing for local entrepreneurs, etc. Finally, it will assist the country to develop strong partnerships with the private sector in the development of tangible MHPP projects in rural and peri-urban areas.

The fourth intervention is transversal. It is dedicated to communication, public relations and marketing activities for the mobilization of public and private investment dedicated to the development of additional MHPP, to reach an installed capacity of 100 MW in rural areas by 2020. Gaps will be filled in, in terms of information dissemination (communication strategy that highlights the national policy and the economic incentives, technology standards, potential sources of funding, existing capabilities and those under development, etc.). It will underpin the development of tools that guide investment, and assist the energy sector to manage various risks. Synergies with other projects will be made possible under this intervention, and best practices and lessons learned will be shared through communication tools, with other countries and partners.

UNDAF Programme Period:	2013-2017	Total allocated resources:	17,337,669 USD
Atlas Award ID:	00087442	<i>Regular:</i>	
Project ID :	00094434	- GEF	3,187,669 USD
PIMS#	4690	- UNDP (TRAC)	400,000USD
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End Date:	June 2021	* Government	13,000,000 USD
PAC Meeting Date:	tbd	* Donor (Gov. of	750,000 USD
Management Arrangements	NIM	South Korea and	
		Netherlands)	

Agreed by MEDD:

Date:

Agreed by MERH:

Date:

Agreed by UNDP:

Date:

Table of contents

List of Acronyms	6
1. Situation analysis	9
1.1. Introduction.....	9
1.2. National energy context	10
1.3. Electricity market analysis.....	11
1.5. Small scale hydropower and the SE4ALL initiative in DRC.....	14
1.6. The development of MHP in RDC: characteristics, potential and barriers	15
2. Intervention strategy	20
2.1. Relevance of the project under the United Nations Development Assistance Framework (UNDAF).....	20
2.2. UNDP support strategy for the development of renewable energy in DRC: past initiatives and the publication of an Atlas on Renewable Energy	21
2.3. Review of national projects, policies and strategies	22
2.4. Analysis of stakeholders in DRC.....	23
2.5. Synergies	28
2.6. Capacity building needs	30
3. Objectives of the project, results and activities.....	32
3.1. Project objective	32
3.2. Project Outcomes.....	32
3.3. Expected results.....	33
3.4. Project Outcomes, Outputs and Activities.....	33
3.5. Project indicators, risks and assumptions.....	65
3.6. Sustainability and replicability	68
3.7. Global social and environmental benefits and GEF intervention rationale.....	70
3.8. GHG emissions reduction	71
CO ₂ _direct = e * I * c.....	73
3.9. Cost effectiveness	74
3.10. Gender issues	79
4. Logical framework.....	80
5. Total budget and Pluri-annual work plan	87
5. Management arrangements.....	92
6. Monitoring framework, evaluation, reporting and auditing.....	95
7. Legal context.....	99
8. Annex 1: Risks analysis	102

9.	Annex 2: Draft Terms of reference of key project personal – Project Manager / Administrative Officer.....	104
10.	Annex 3: Identified pilot sites.....	106
11.	Annex 4: Description of UNDP Country Office support services.....	110
12.	Annex 5: Content of the Technical trainings Programs (for activites 12.5.1 and 12.5.2) 111	
13.	Annex 6: Results of the financial sustainability of the MHPP based on the RETScreen software analysis.	114
14.	Annex 7: DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES	119

List of Acronyms

AfDB	African Development Bank
AFD	Agence Française de Développement
ANRE	Autorité Nationale de Régulation du secteur de l'Electricité
ANSER	Agence Nationale des Services Energétiques Ruraux
AR5	Fifth Assessment Report
AWP	Annual Working Plan
BMZ	German Federal Ministry for Economic Cooperation and Development
CAPEX	Capital expenditures
CAPP	Central Africa Power Pool
CATE	Cellule d'Appui Technique à l'Energie
CDM	Clean Development Mechanism
CLED	Comités Locaux d'Electrification et de Développement
CNE	Commission Nationale à l'Energie
CO	Country Office
COMESA	Common Market for Eastern and Southern Africa
COP	Conference of the Parties
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COPEMECO	Confédération des Petites et Moyennes Entreprises du Congo
CSO	Civil Society Organization
DAM	Day Ahead Market
DFID	Department for International Development (United Kingdom)
DRC	Democratic Republic of Congo
EAPP	Eastern Africa Power Pool
ECCAS	Economic Community of Central African States
EDC	Electricité du Congo
EPC	Engineering, procurement and construction
ESCO	Energy service company
EU	European Union
EUEI PDF	EU Energy Initiative – Partnership Dialogue Facility
FEC	Fédération des Entreprises du Congo
FoDER	Forum sur le Développement des Energies Renouvelables
FOMULAC	Fondation Médicale de l'Université de Louvain en Afrique Centrale
FONEL	Fonds National d'Electrification
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas

GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ha	hectare
HDI	Human Development Index
IBTP	Institut de Bâtiment et des Travaux publics
IEA	International Energy Agency
IFC	International Finance Corporation
IFI	International Financial Institution
IMF	International Monetary Fund
INPP	Institut National de Préparation Professionnelle
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
IRC	Innovative Rescue Committee
IRR	Internal Rate of Return
ISTA	Institut Supérieur de Techniques Appliquées
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
KOICA	Korea International Cooperation Agency
ktoe	Kilotonne of Oil Equivalent
kW	kilowatt
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
MDG	Millennium Development Goals
MEDD	Ministère de l'Environnement et du Développement Durable
MERH	Ministère de l'Energie et des Ressources Hydrauliques
MHE	Micro-hydroelectricity
MHP	Mini- and micro-hydropower
MHPP	Mini- and micro-hydropower plants
MRV	Measuring, Reporting, and Verification
Mt CO ₂ e	Million metric tons of carbon dioxide equivalent
Mt	Megatonne (i.e., million metric tonnes)
MW	Megawatt
M&E	Monitoring & Evaluation
NAMA	Nationally Appropriate Mitigation Action
NASA	National Aeronautics and Space Administration
NGO	Non-Governmental Organisation
NIM	National Implementation Modality
NPV	Net Present Value
OBA	Output-Based Aid
OPEX	Operations expenditures
O&M	Operations and Maintenance

PASEL	Projet d'appui au développement du secteur de l'électricité
PIF	Project Identification Form
PIR	Project Implementation Review
PMEDE	Projet de développement du Marché d'Électricité pour la consommation Domestique et à l'Exportation
PMU	Project Management Unit
PMTRR	Programme Multisectoriel d'Urgence, de Réhabilitation et de Reconstruction
PPG	Project Preparation Grant
PPP	Public Private Partnership
PROVIM	Programme Villages Modernes
PSC	Project Steering Committee
QPR	Quarterly Progress Report
RCU	Regional Coordination Unit
REGIDESO	Régie de distribution d'eau
REEEP	Renewable Energy and Energy Efficiency Partnership
RERA	Regional Electricity Regulators Association of Southern Africa
RETScreen	Renewable Energy Project Analysis Software
SAAP	Southern African Power Pool
SBAA	Standard Basic Assistance Agreement
SE4ALL	Sustainable Energy for All
SME	Small and Medium Enterprise
SNEL	Société Nationale d'Électricité
SNV	Stechting Nederlandse Vrijwilligers/Netherlands Development Organisation
STEM	Short Term Electricity Market
UN	United Nations Organization
UNCT	United Nations Country Team
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIKIN	Université de Kinshasa
USD	US Dollar

1. Situation analysis

1.1. Introduction

Democratic Republic of Congo (DRC) is Africa's second largest country, with a total of 2,345,409 km², with immense economic and energy resources. It is also one of the world's poorest nations with the second-lowest Human Development Index (HDI) in 2013¹. Over 70% of Congolese residents live below poverty line and only 9% have access to electric grid. For the rest, the only power supply alternative is via decentralized generators/mini-grids run on imported oil and coal.

However, the costs of imports are becoming exorbitant for both importers and consumers who operate under extremely difficult and unpredictable economic and political conditions. As a result, over 60 million Congolese predominantly rely on ligneous fuels (wood, charcoal, plant residues, etc.) for their basic energy needs, a major factor in destruction of the forests and rise of GHG emissions. With envisaged steady increase in population volume and in the absence of affordable and climate-friendly power supply alternatives, GHG emissions from rural energy use in DRC are set to grow.

Given its location in the center of the immense hydrographical basin with its bodies of water covering more than 86,080 km² and a green ocean of dense tropical vegetation receiving around 30 % of the annual precipitation for the entire African continent, DRC is blessed with nearly unlimited hydropower resources.

The exploitable hydropower potential is estimated to be in the order of more than 700 TWh/year or 66% of Central Africa's potential, 35% of the whole of the continent's, and 8% of the world's hydro potential. When expressed as firm power capacity, this is equivalent to 100GW. There is a huge gap, however, between the potential and the reality: less than 3% or 2.6 GW is currently being exploited, mainly via large Inga Dam (2.4 GW).

For DRC, one of the most sparsely populated countries in Africa², harnessing abundant hydropower resources via decentralized small scale hydropower-based mini-grid systems can provide for an economically viable, environmentally sustainable and climate-friendly power supply alternative, especially in the country's remote and rural areas. Nevertheless, uncertainties about the costs, and the access to these reliable technologies, are high. In the case of DRC, it is a justification for a financial support, considering that the most abundant source of renewable energy is hydropower. This project document, using the Global Environment Facility (GEF) funding criteria, and with the technical support of the United Nations Development Programme (UNDP), focuses therefore on the promotion of mini- and micro-hydropower in the Democratic Republic of Congo (DRC) with the goal of accessibility of rural populations to electricity nearby.

¹ <http://hdr.undp.org/en/data>

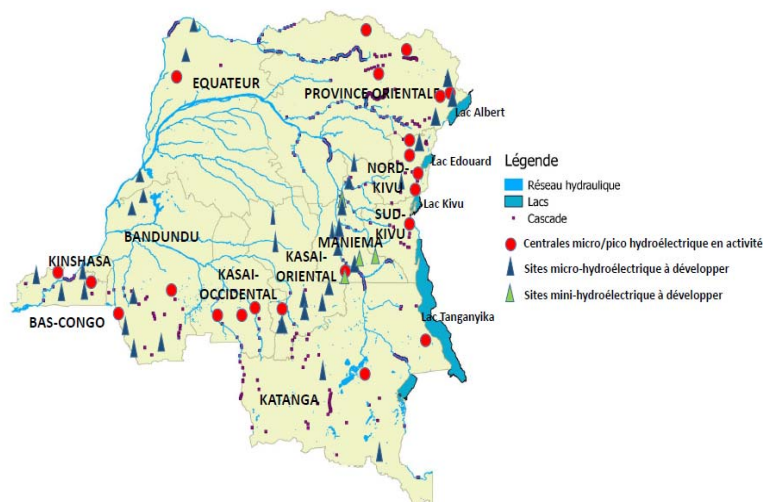
² 22 inhabitants per square kilometer

1.2. National energy context

DRC is a country with a chronic energy deficit despite its potential. More than 70% of the Congolese population lives below the poverty level and only 9% had access to electricity in 2011³.

Energy supply in the country is characterized by the dominance of biomass (conventional energy), a low interest of the renewable energy potential, and a dependence vis-à-vis imported oil⁴. Added to this is the low energy efficiency of the energy supply chain (production, transportation and distribution). In most cases, power is supplied in rural areas by means of generators connected to small decentralized networks. However, the economic and environmental costs of these energy sources are becoming more difficult to bear, due to the increasing price of fossil fuels or the deforestation rates observed in the country. Thus, more than 60 million Congolese depend mainly from wood fuel for their basic energy needs, resulting in the destruction of forests and rising emissions of greenhouse gases (GHG).

Graph 1. Map of the potential MHPP sites in DRC
(Atlas des Energies Renouvelables, 2014)



With a potential production capacity estimated at about 100,000 MW from hydro power alone, the country's total installed capacity is approximately 2,400 MW, or less than 3% of that potential. Of this, hydropower accounts for nearly 99%, with the remaining supplied by about 60 small and isolated solid-fuel thermal plants. A handful of large industrial enterprises maintain their own production capacity. The two hydro plants at Inga between them account for 1,775 MW of installed capacity (351 MW at Inga I, 1424 MW at Inga 2), or roughly 70% of the country's total.

At the same time, with the second largest river basin in the world, DRC has vast hydrologic resources, with water streams covering a distance of more than 86 000 km², receiving about 30% of the annual precipitation of the entire African continent.

³ Rapport National « Energie Durable pour Tous à l'Horizon 2030 », SE4ALL, RDC, PNUD, août 2013. http://www.cd.undp.org/content/dam/dem_rep_congo/docs/eenv/UNDP-CD-RAPPORT-ENERGIE-DURBALE-POUR-TOUS-HORIZON-2030.pdf

⁴ *Ibidem*.

The potential in terms of hydropower is estimated at over 70 TWh per year or 66% of the potential of Central Africa and, respectively, 35% and 8% of the potential of the entire African continent and the world. So far, less than 3% of the sites are in operation, mainly in Inga. The state of the Inga plants epitomizes the state of the country's generation capacity. Currently, available capacity at Inga 1 and 2 totals about 700 MW out of 1,775 MW of installed capacity.

Regarding power supply, and given the overload and poor condition of the production, transportation and distribution facilities, energy services are deteriorated. This results in frequent and widespread blackouts. Thus, the per capita electricity consumption in DRC has decreased from 161 kWh in 2002 to 91 kWh in 2011 against an average estimated at 525 kWh per year in Africa. Rural areas, meanwhile, remain largely without electricity due to the lack of a national energy policy and planning.

The transmission system in DRC consists of several unconnected electricity sub-networks. There are three principal components that together span 5,547 km: a high voltage line (500 kV) that runs 1,740 km from Inga to the Katanga region, and three large sub-networks, composed of high-voltage lines varying between 50 kV and 220 kV (Western network, Southern network, and an Eastern network). In addition, there is a variety of independent mini-grids, organized around smaller urban and industrial centers across the country, powered by small power plants⁵.

The distribution system is structured around four principal networks that account for 90% of total electricity consumption in DRC and approximately 400,000 connections, out of which 75% are in the Kinshasa region, 8% in the Bas Congo region, 11% in the Katanga region; and about 6% in the Kivu region. The distribution system includes roughly 1,500 km of medium voltage (6.6 to 30kV) lines and 4,500 km of low voltage (0.4kV) lines.

1.3. Electricity market analysis

In DRC, the prevailing tariff structure heavily penalizes high-voltage users to the advantage of providing large and unsustainable subsidies to the broad consumer base. Some Independent Power Producers (IPPs) are, however, entitled to sell electricity at a cost-recovery tariff. At the same time, 85% of the electricity in DRC is consumed by high-voltage users. The total demand (as represented by sales) in 2012 was about 6,000 GWh, with low voltage power accounting for about 5%. Demand is projected to increase annually by about 5% in the coming years, but could increase significantly more as the electricity infrastructure expands.

The table below compares the various tariffs applying in DRC, from the social tariff to the medium voltage tariff.

Table 1: Electricity Tariffs in DRC (cUSD/kWh)⁶

⁵ World Bank, 2012
⁶ <http://www.peac-ac.org>

		SNEL
		(RD CONGO)
Social tariff (E = 100 kWh/month)	1 kW	2.65
Monophase domestic usage (E = 200 kWh/month)	2 kW	3.90
	4 kW	3.90
Three phases domestic usage (E = 600 kWh/month)	6 kW	8.70
	10 kW	8.70
Three phases commercial usage (E = 1800 kWh/month)	12 kW	11.00
	15 kW	11.00
Mid-industry & motive power (E = 2500 kWh/month)	20 kW	15.00
	25 kW	15.00
Medium voltage (E = 35000 Wh/month)	250 kW	9.80

Another important dimension of the electricity market of DRC is related to the country's central position in the continent, implying a regional market organized under power pools. In terms of imports and exports, electricity is sold to Congo Brazzaville, Rwanda and Burundi, and 200 MW is imported from Zambia for the Katanga Province. Cross-border power trade is usually institutionalized within power pools. DRC is therefore a member country of three African power pools.

The Central Africa Power Pool (CAPP)⁷ is the specialized agency of the ECCAS for electricity. Created in 2003, CAPP was mandated in 2004 as a Specialised Institution of ECCAS with the goal to implement ECCAS energy policy. ECCAS' mandate is to improve upon regulatory and contractual legislations related to the exchange of energy within the 10 countries in the region. CAPP seeks to secure energy supply within the ECCAS and achieving socio-economic development of Central Africa through the regional electricity market. It aims at implementing a regulatory framework for promoting and securing power investments and regional trade. An Electricity Market Code was adopted in October 2009 by head of States and Government Conference held in Kinshasa. Today, the Inga site provides power to the CAPP. Power supplied from DRC is a critical enabling factor for the development of a competitive power market in both sub-regions, with reliable, low-cost power supporting industrial competitiveness, private sector investment and regional growth and development. As a consequence, DRC generally and the Inga specifically are currently central to most discussions in southern and central Africa to developing hydropower resources on a regional basis⁸.

The Southern Africa Power Pool (SAPP)⁹ started in 1995 as a cooperative pool; meaning that members seek to maximize economic and system reliability benefits through trade, while retaining maximum autonomy for individual members. SAPP is a specialised institution of the Southern

⁷ <http://www.peac-ac.org>

⁸ Pool Energétique de l'Afrique Centrale (PEAC), 2011. Présentation générale du secteur électrique en Afrique Centrale, Europe Aid/126679/C/SER/CG; WYG International, 1 May 2011.

⁹ <http://www.sapp.co.zw>

African Development Community (SADC) with the objective to improve upon energy supply within the SADC by integrating national power system operations into a unified electricity market. To that end, SAPP coordinate the planning and operation of the electric power system among member utilities and provide a forum for regional solutions to electric energy problems. A Regional Electricity Regulators Association of Southern Africa (RERA) was established by the SADC as a formal association of electricity regulators in July 2002, more particularly in terms of the SADC Protocol on Energy (1996) and of the SADC Energy Cooperation Policy and Strategy (1996). RERA's mission is to facilitate harmonisation of regulatory policies, legislation, standards and practices and to be a platform for effective cooperation among energy regulators within the SADC region. The membership to RERA is open to electricity supply industry regulators in each country within SADC. Each country is limited to a single membership. For power trade, SAPP is at an advanced stage with circa 30 bilateral contracts already signed between the member countries and with an active role played by the Short Term Electricity Market (STEM) since 2001 and by the Day Ahead Market (DAM) since 2009. Institutional set up and market rules and regulations are already implemented. Further development of the regional market is however constrained by the lack of generation capacity linked with congested and insufficient interconnections capacity.

Under SAPP, South Africa is by far the major exporter of power, followed by DRC with circa 850 GWh. The other countries are mainly importers of power.

Similarly to CAPP and SAPP, the Eastern Africa Power Pool (EAPP)¹⁰ is the specialized agency of the Common Market for Eastern and Southern Africa (COMESA) for the electricity market. EAPP was conceived in May 2003, with the objectives to optimise the usage of energy resources available in the COMESA region by working out regional investment schemes in power generation, transmission and distribution, taking into account the socio-economic and environmental aspects, to reduce electricity cost by using power systems interconnection and increasing power exchanges between countries, and to provide efficient co-ordination between various initiatives taken in the fields of power production, transmission and exchanges in the COMESA region.

Table 2: Imports & exports of electricity per country (GWh) within EAPP¹¹

Country	Imports (GWh)	Exports (GWh)
Burundi	83	-
Djibouti	-	-
East DRC	-	44.3
Egypt	251	814
Ethiopia	-	-
Kenya	26	-
Rwanda	84.7	-
Sudan	-	-
Tanzania	68	-
Uganda	-	73
Total	512.7	931.3

¹⁰ <http://www.eappool.org/>

¹¹ EAPP, 2011. Final Master Plan, SNC Lavallin & Parsons Brinckerhoff, May 2011, The East African Power Pool (EAPP)

In November 2006, EAPP has subsequently been adopted as a COMESA specialized institution and as a vehicle for the enhancement of energy interconnectivity in the region by the Heads of State and Government at the 11th Summit of COMESA in Djibouti.

In conclusion, exports from DRC have reached 1,230 GWh in 2010, as compared to the imported 660 GWh during the same year. A limited regional power trade is taking place between DRC and other countries in the region through the interconnections between DRC and Congo (60 MW capacity), DRC and Zambia (150 MW capacity), and DRC to Burundi, CAR, Rwanda and Angola with MV cross-borders sales. The commissioning end 2010 of Imboulou hydropower plant in Congo has substantially decreased its imports from DRC.

Table 3: Power trade per power pool¹².

	CAPP 2009*	EAPP 2008*	SAPP 2010*
Consumption (GWh)	15 238	124 017	260 081
Imports (GWh)	38	513	19 565
Exports (GWh)	915	931	15 301
Electricity traded (%)	0.2%	0.4%	7.5%

*Base year: most recent year for which data is available for all countries of the power pool.

The project is therefore of particular importance to complement the regional efforts regarding the development of power trade. It is a contribution and a logical accompaniment of the country to consider the power market from a regional, national and local perspective. Promoting the development of mini- and micro-hydropower plants (MHPP) is an opportunity for DRC to develop a green economy and an environmentally friendly regional and national energy system. For the purpose, the Government of DRC has adopted an approach based on two pillars: the first pillar consists in finding solutions to energy shortages in cities, and the second to encourage a decentralized power supply system in rural areas.

1.5. Small scale hydropower and the SE4ALL initiative in DRC

The project entitled “Promotion of mini- and micro-hydro power plants in the Democratic Republic of Congo” is implemented within the framework of the "Sustainable Energy for All" initiative¹³ (SE4ALL) launched by the Secretary General of the United Nations (UN). DRC joined in December 2012 at the SE4ALL Initiative with a national agenda and a strategy¹⁴. The goals set under this strategy are i) increasing the access to electricity in urban areas from 35% in 2011 (for an estimated urban population of 25.5 million inhabitants) to 100% in 2030, and ii) increasing the access to electricity in rural areas from a very low level of 1% in 2010 (for an estimated population in rural areas of 47.3 million) to 100% in 2030. Combining the urban and rural areas, the goal is to increase the access to electricity from a level of 9% in 2011 (for an estimated population of 72.8 million inhabitants) to 100% in 2030 (for an estimated population of 143 million inhabitants).

¹² ICA, 2011. Regional Power Status in African Power Pools. Report from the Infrastructure Consortium for Africa (ICA), November 2011

¹³ <http://www.se4all.org/>

¹⁴ http://www.cd.undp.org/content/dam/dem_rep_congo/docs/eenv/UNDP-CD-RAPPORT-ENERGIE-DURBALE-POUR-TOUS-HORIZON-2030.pdf

To reach these ambitious objectives by 2030, a final electricity consumption of about 149,528 GWh (or 12,857 ktoe) is expected by 2030, corresponding to a multiplication by 24 of the 2011 consumption level, or 11.25 times the average electricity consumption per capita, from 0.008 toe/capita (i.e. 93.04 kWh) in 2011 to 0.09 toe/capita (i.e. 1046.70 kWh) in 2030.

This difference appears to be considerable and superior to all previous growth forecasts in the electricity sector in DRC, since the ambition is to make electricity available to the entire population. One way identified¹⁵ to fill the gap in terms of electrification rate or low population access to electricity is hydropower.

The hydro-electric potential in DRC is estimated at circa 100,000 MW. However, only 2,465.12 MW are installed, or 2.5% of the total potential. Despite this significant hydropower potential, there was until recently no political incentive and no fiscal or economic stimulus towards private initiatives, and the financial, environmental and administrative capacities were limited.

The legal framework governing the electricity sector has been extensively revised with Law No.14/011 of 17 June 2014. A new phase opens with this law, which requires an effort for its implementation, among others related to the promotion and the development of MHPP.

The new electricity law enacts the creation of two regulatory institutions placed under the Ministry of Water Resources and Energy (Ministère des Ressources Hydrauliques et de l'Electricité/MERH). The first one is the National Regulatory Authority for the Electricity Sector (Autorité Nationale de Régulation du secteur de l'Electricité/ANRE) and the second one is the National Agency for Rural Energy Services (Agence Nationale des Services Energétiques Ruraux/ANSER). This should put an end to the complexity that prevailed so far, especially with regards to rural electrification.

This political will, especially with the development of energy services in rural areas, will be translated in the field via the Modern Villages Programme (PROVIM).

Domestic and foreign investment in MHPP will depend of a number of parameters including this renewed jurisdictional and legal environment in the power sector, a proper economic stimulus via, for instance a feed-in tariff, political will, and, at the project level, financial profitability of the sites identified as the most interesting to invest in.

Thus, the development of hydropower appears as a solution to the low rate of electrification. The project aims at participating to the implementation of the new law and the SE4ALL initiative, with for instance a component focusing on a policy and institutional framework for private & community investment in micro- and mini-hydropower (MHP).

1.6. The development of MHP in RDC: characteristics, potential and barriers

If the legal environment has become more favorable, barriers to the development of small scale hydropower still exist. Current and future risks as well as the barriers to technology development are analyzed, and measures reducing or mitigating these barriers are considered and proposed,

¹⁵ *Ibidem.*

to ensure the success of the project. Prior to analyze the barriers, it appears important to define MHPP and to review the potential for development.

Characteristics of MHP

Large or small, hydropower is considered as a suitable source of energy in DRC, especially considering energy supply independence, access to energy and climate change mitigation. At the same time, the development of MHPP is sometimes made difficult by large flagship projects that are nonetheless essential to the country. In this section, hydropower plants are characterized to avoid any confusion about the size of the targeted projects.

What is meant by micro, mini, small or large hydropower? Generally, hydropower plants are defined as small when the installed capacity is below 10 MW. Below 0.5 MW, it is even defined as micro-hydropower plant. The following table presents a typology of facilities according to their size. These definitions apply in the project document.

Table 4. Typology of hydropower plants (HPP) according to their installed capacity

Terminology	Installed capacity
Pico-HPP	< 20kW
Micro-HPP	20 – 500 kW
Mini-HPP	500 kW – 2 MW
Small-scale HPP	2 – 10 MW
Medium scale HPP	10 – 100 MW
Larges HPP	> 100 MW

The proposed project targets the development of facilities with an installed capacity going from 20 kilowatts to 2 megawatts.

The reasons of the selection of these two options are first that, in parallel to the large hydropower projects, many small-scale projects have already been identified, for example in Katende and Kakobola. The number of sites that could be under exploitation as MHPP is estimated to be around 750. This inventory results from a process which included technical diagnosis of many sites and the publication in 2014 of the Renewable Energy Atlas for DRC. This process concluded that the potential for the development of MHPP is significant.

Second, in addition, the question of the network needs to be addressed. It is important to distinguish sites that can easily be connected to a network from remote sites. Sites easily connected will inject power in an existing network, based on a power purchase agreement with a transmission and/or distribution company. This contract usually ensures that all electricity produced can be sold at a predetermined price during a given period. This secures the investment and covers the operational expenditures.

However, given the political, technical and financial risks, such projects do not have access to finance and thus need support for their proper implementation. To the extent that these plants provide power to an existing network, they mainly improve the electricity supply of the users who are already connected, unless the existing network is extended to new customers because of the increased capacity.

This previous case is different from a case where plants provide a surplus to the national grid. This occurs when an isolated MHPP, which served a limited number of households connected to

a mini-network, is then connected to a larger network. This new share of electricity, the surplus, is not consumed locally.

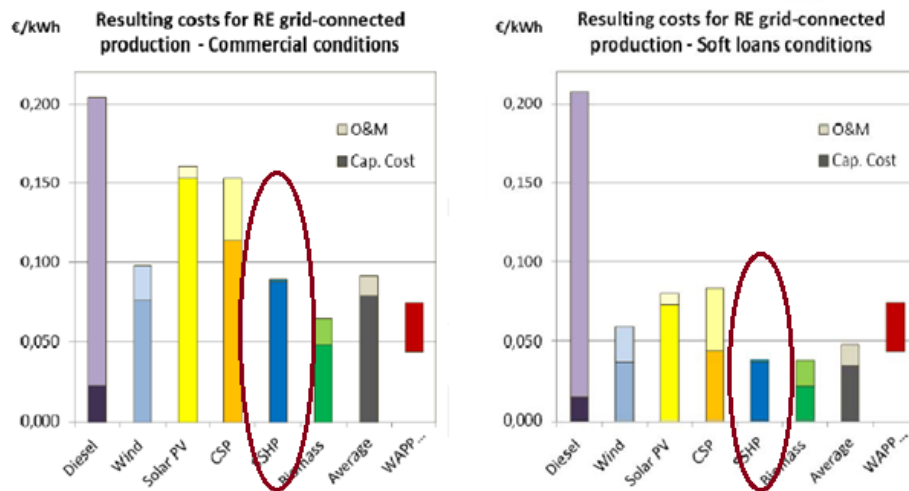
Another case, the most common in DRC relates to isolated systems that feed a remote mini-network. Such networks often suffer from a relatively low load factor, mainly because rural households consume electricity primarily in the evening. Therefore, the MHPP do not allow a return on investment in a fast and attractive delay for private investors. The load factor can be improved if electricity is also consumed by small industries. These systems are designed to supply additional rural households, as well as small and medium enterprises (SMEs). It makes them independent of the high and versatile cost of fuel needed to operate the generators. In such situations, MHPP do have a significant impact on poverty reduction and greenhouse gas emissions mitigation.

MHP potential in DRC

In parallel to the large hydropower projects, many small-scale projects have already been identified, for example in Katende and Kakobola. The number of sites that could be under exploitation as MHPP is estimated to be around 750. This inventory results from a process which included technical diagnosis of many sites and the publication in 2014 of the Renewable Energy Atlas for DRC¹⁶. This process concluded that the potential for the development of MHPP is significant.

In addition, MHP is usually considered as inexpensive for decentralized power generation, compared to other technologies.

Graph 2. Levelized cost of electricity per technology (by 2020)



In the end, in terms of perspectives, with the publication of the Renewable Energy Atlas, and the SE4ALL initiative, greater attention is paid to mini- and micro-hydropower as a way to improve universal access to energy services in rural and remote areas. In addition, the technology is proven, reliable compared to other technologies, and able to provide base load capacity in certain circumstances. It can play an important role in areas that rely heavily on expensive fossil fuels.

¹⁶ <http://www.cd.undp.org/content/rdc/fr/home/presscenter/articles/2014/09/19/le-premier-atlas-interactif-des-nergies-renouvelables-en-rdc/>

If MHP can play a vital role in facilitating energy access in remote areas while meeting social (e.g. in job creation), environmental (substituting carbon intensive technologies with clean technologies) and economic targets (lower cost per MWh), yet many identified and surveyed sites in DRC are not developed for various barriers that must be confronted.

Financial barrier

If the potential for MHPP is high in DRC, and if MHPP have many advantages, e.g. low negative impact on the environment and positive impacts at the social level in rural areas, their development is deterred first because of financial reasons. One of the main barriers is the lack of access to finance, because there is a general belief that large HPP benefit from economies of scale, and appear, rightly or wrongly, as more profitable.

Significant upfront investment requirements because of high capital expenditures (CAPEX) remain a roadblock for implementation of many projects. MHPP are capital intensive with significant development and construction costs and a long payback period. Especially in a constraint of poverty on the demand side which limits payback guarantee, the financial conditions are generally beyond the capacity of local companies or communities. In addition, the local banking sector is not sufficiently capitalized to facilitate financing for MHPP with longer pay-back and substantial risks.

Another financial barrier is due to scarce information about the potential and the benefits of MHP for rural electrification and development. Prior to the publication of the Renewable Energy Atlas, there was little information and only fragmented data about prospective sites, their hydrological, climatic and other characteristics. Even when such studies exist, they often are not publicly available. Basically, there is no single information point where a potential developer can receive required guidance and data to make an informed investment decision. The Government of DRC and its entities are unable to pull it together on its own due to limited budget resources, staff capacities, lack of prior experience and over-all vision of how to promote MHP and private sector investment. Whereas national energy strategy does acknowledge the importance of MHP development in tackling energy deficit in rural areas of DRC, the primary focus and efforts of the Government so far have been on addressing urban energy deficit and facilitating implementation of large hydro power projects with public and IFI financing.

Promotion of MHP requires different approach, more geared towards private sector and local communities, and the one which implies open and transparent access to information for investors. Now that Renewable Energy Atlas is publicly released to disclose the information necessary to invest, some good business models of MHPP which works well in the context of DRC are needed to catalyze the private sector's involvement. The scarcity of successful and sustainable MHPP was until now limiting opportunities to raise the awareness and to build up the confidence of local communities, project developers and investors, and was in itself a big deterrent to market development for the perceived risks of a first-of-its-kind investment are always higher than the risks associated with replication of a successful model.

In the proposed project, a business model for private sectors to enable access to finance despite the demand side's financial constraint is introduced.

Barriers due to the legal, regulatory and institutional environment

The legal framework has long been a barrier to the development of MHPP in DRC because there are no specific provisions enabling independent power producers (IPPs) to implement and operate MHP-based mini-grids. There are a number of critical issues, such as land and water use by MHPP, feed-in-tariffs, certification and licensing, procedures for conflict resolution, incentive measures, etc. Institutional and human capacities at all levels (sub-regional, national and local) are also insufficient (if at all existent) to support rural electrification based on decentralized MHPP. While there is now a new law on electricity, the Agency for Rural Electrification (ANSER) is not yet fully established and there is no dedicated staff or unit in charge of rural electrification within the MERH.

In conclusion, one reason for the limited investments in MHPP is due to the legal uncertainty and the political risks that prevailed, considering that both risks are intertwined. The new law from June 2014 should provide a better visibility to investors and a more secure environment. But the risk remains as to how the law will be enforced. For instance, in provinces, the legal expertise is missing to enable a proper interpretation of the law. The project aims at supporting the implementation of the law, by promoting it in the provinces.

Technological and capacity barrier

The technology for MHP in DRC is in a very nascent stage. There are only a few local manufacturers capable of assembling simple MHP installations based on imported machinery and turbines, but they lack the technical and engineering capacities to ensure optimal system design, installation and maintenance. In the rural areas, there is only very limited local technical expertise available on how to properly administer, operate and maintain MHP systems. The low quality and quantity of skilled and competent workers in the power sector adds additional risks and increases the cost of MHP operation due to the need to rely on expensive imported services even for basic repair and maintenance.

The capacity to manage small grids and to operate MHPP in remote areas is another challenging barrier. It applies specifically to Operations and Maintenance (O&M). The lack of experience with and demonstration of sustainable O&M of MHP-based mini grids appears to be a key bottleneck and the reason for the failure of past donor-funded projects. The barrier related to the limited expertise in the country is aggravated by the fact that DRC is a post-conflict society and the conflict has still not fully disappeared in some parts of the country. The ranks of experienced managers and trained technicians, already in short supply in rural areas, have been further depleted due to the effect of conflicts.

Before any large-scale replication can take place, a sustainable O&M model has to be demonstrated. The key aspects of such a model currently missing are: local capacities for technical oversight over plant operations, efficient tariff structures which adequately cover both start-up and O&M costs, effective financial management structure, billing and payment collection system, customer relations and conflict resolution procedures, engagement of productive end-users. This poses again the question of the financial risks.

As a result of these barriers, the current average micro- and mini-hydropower output is very low, with about 100kW, from circa 250 operational MHPP (75% being owned by the Catholic Church) for a total installed capacity comprised of circa 25 MW. Most of already existing installations are nowadays no longer operational. One of the main issue was the “donor driven” model type of

these installations. Any sustainable MHPP installation has to come up with a viable business model.

In order to further understand these intermingled barriers, and to address them with the proposed project interventions, an analysis of the power market is necessary.

2. Intervention strategy

2.1. Relevance of the project under the United Nations Development Assistance Framework (UNDAF)

The United Nations Development Assistance Framework (UNDAF) in DRC for the 2013-2017 period sets out the main areas of cooperation between the Government of DRC and the United Nations Country Team (UNCT). The UNDAF is a strategic tool to promote coherence and effectiveness of United Nations programs in support of national priorities in DRC. As such, it provides an overview of strategic outcomes (effects) and intermediate outcomes (products) that can be individual or joint programs between agencies of the United Nations during the 2013-2017 program cycle.

The responses proposed by the United Nations are based on an analysis of the challenges, particularly in terms of governance, inclusive economic growth, access to basic social services, protection of the environment, stabilization and peace building. On the basis of its comparative advantage, the United Nations therefore intend to contribute to the achievement of six outputs.

The UNDAF 2013-2017 sets in particular the following diagnosis: despite the strong potential of the country in hydro power (over 100,000 MW of which only 2.5% are currently operating), domestic energy used by Congolese households comes for 95% from the biomass (charcoal and firewood). It leads to deforestation, biodiversity degradation and soil erosion. The need to find alternatives to the use of charcoal and firewood in rural areas and to promote rural electrification using renewable energy is a priority of the UNDAF.

Promoting MHPP in DRC falls under the fifth outcome, spelt as follows: “The Congolese State improves the management of its natural resources (mining, energy, biodiversity and land) and the associated benefits, the management mechanisms, and the country is engaged towards the greening of its economy”¹⁷.

Within this outcome, there are several interventions, three of them being in relation to the project rationale:

- Intervention 5.1. “Environmental strategies and policies, including in the field of climate change adaptation and mitigation, are elaborated and implemented”
- Intervention 5.6. “Support programmes towards climate change adaptation and mitigation are experimented and improved, through renewable energy, agriculture, agro-forestry and improved cook-stoves”

¹⁷ Plan-Cadre des Nations Unies pour l'Assistance au Développement — UNDAF 2013–2017, ‘Unis pour le Développement de la RDC », République Démocratique Du Congo, octobre 2012.

- Intervention 5.7. “Strategic partnerships are facilitated and in place to promote the governmental actions in the transformation of the economy (network of knowledge sharing, advocacy clusters, ownership and transfer Of clean technologies, expertise in negotiations, multi-donor funds, participation of communities, etc.)”.

The project will hence contribute to the development and the implementation of strategies and environmental policies to mitigate climate change and is consistent with its axis on “Sustainable Natural Resources Management & Climate Change”. The project will contribute to the programmatic assistance in the area of climate change. It will also foster strategic partnerships and participate in the promotion of governmental action in the transformation of the rural economy.

Hence, through the UNDAF, UNDP assists the country in achieving its ambitions, especially to increase the electrification rate in rural areas, to slow the rate of forest degradation and to reduce emissions of greenhouse gases (GHG) to mitigate the negative effects of climate change.

Besides, in terms of renewable energy, UNDP supports the Government of DRC for many years. This must be understood in the transversal worldwide SE4ALL initiative.

The activities outlined in the project document are based on several past and current initiatives and projects in the field of renewable energy, especially targeting micro- and mini-hydropower.

2.2. UNDP support strategy for the development of renewable energy in DRC: past initiatives and the publication of an Atlas on Renewable Energy

UNDP’s support to the Government of DRC in the field of renewable energy is becoming more important and larger in terms of projects portfolio. In relation to DRC's endorsement of the initiative "Sustainable Energy for All", UNDP has announced the creation of a SE4ALL hub for decentralized solutions to support the country process and a regional mechanism called “Regional Energy Project of UNDP for Africa”.

To help DRC to address key challenges in the energy sector, UNDP CO has decided to support the Government in its mission to provide energy services for the development of income generating activities especially in rural areas. Thus, it was decided to set up a national action plan based on decision support tools (energy audits, energy planning tools, projects feasibility studies, etc.) and on the financing of MHPP.

A large diagnosis of the situation in the energy sector, with studies for decision support in the selection of options for sustainable energy development, has enabled to describe accurately and objectively the problems of the energy sector in the provinces of the DRC and identification of elements possible solutions or options. It also provided the foundation for the exploration of the most promising sites for local energy planning and a scientific basis for the development of energy policies.

UNDP and the Government of DRC have invested in mobilizing both national and international experts, in the involvement of the public sector and the private sector, and in creating synergies with technical and financial partners to support the implementation of the national SE4ALL strategy and of related priority programs for the country. Thus, with the support of UNDP, the Ministry of Energy and Hydraulic Resources (MERH) conducted in 2014 an inventory of renewable energy potentials throughout the country (provinces, territories and villages). This overview has been published in the form of a Renewable Energy Atlas.

This inventory aims at facilitating the achievement of the SE4ALL agenda that the DRC has fixed, with the following objectives:

- Doubling the rates of access to electricity by 2018, from 9% to 18%;
- Launching vast hydroelectric projects across the country;
- Promoting incentive measures with the new law on electricity.

To be more precise on the Renewable Energy Atlas, it was achieved not only with the support of UNDP, but also with that of the Netherlands Development Organization (SNV). This document compiles data from several diagnostic studies conducted in different provinces of the country. It is presented as an interactive tool containing more than 600 maps, and therefore represents a major source of information for the identification and development of MHPP.

With these initiatives of analyzing existing energy deficits, making the in-depth inventory of potential hydropower sites in 145 territories of the DRC, and publishing the Atlas, UNDP helps the Congolese Government to proceed with the definition of strategies at national and local level to achieve the SE4ALL goals by 2030.

The project extends past activities in order to implement on the field the findings from these recent research and diagnostic findings. The implementation of these findings is based on an intervention strategy that requires that stakeholders are identified and mobilized, and that national policies and strategies are reviewed, since some project activities will be based on existing national policies and strategies, including the new law of June 2014.

2.3. Review of national projects, policies and strategies

National policies and strategies will be taken into account for the promotion of decentralized small-scale hydroelectric projects:

- The new law on the electricity sector: Enacted on June 17, 2014 under the No. 14/011, it contains several special provisions that allow regulating the operations of power generation by independent operators. It also provides for the establishment of an independent agency responsible for regulating the sector: arbitration of litigations between consumers and suppliers, pricing of services, etc. and also the creation of a public institution in charge of Rural Electrification, considered as the new funding mechanism that will handle the collection and management of sources of funding for the rural electrification program in the DRC.
- Law n°11/009 of 9 July 2011 laying down basic principles for environmental management: The law has 9 chapters and directs "management of the great potential the DRC possesses in natural resources, with a sustainable development perspective for the benefit of its population".
- The Development Project of the Electricity Market for Domestic Consumption and Export (PMEDE): This project co-funded by the World Bank, the African Development Bank (AfDB) and the European Investment Bank (EIB) over the period 2008-2013, incorporated a component that specifically aims to strengthen the capacity of the MERH to develop and implement a scheme of public-private partnership for investment in the field of hydropower.

- The national strategy for the SE4ALL initiative: This strategy focuses on national energy needs and offers a series of programs and measures to address these needs. This strategy is separated in three five-year programs (2016 - 2020, 2021 - 2025 and 2026-2030). Moreover, the technical implementation is done through seven thematic programs (1. promoting rural and peri-urban electrification, 2. substitution of wood energy and access to modern cooking fuels, 3. access and promotion of women (Gender and access to the driving force) and mechanization of hydraulic, agricultural and craft systems 4. Improving energy efficiency, 5. Promotion of new and renewable energy, 6. Strengthening national capacity / SE4ALL, 7. Emergency short-term (2015)).
- The Process of Identification and Participatory Formulation of National Appropriate Mitigation Actions (NAMA): This process, conducted under the supervision of the Ministry of Environment and Sustainable Development (MEDD) started at the end of 2012 in the DRC. It aims to develop an improved methodology for the inventory of greenhouse gases (GHG-I), proposes mitigation actions (NAMA) in agricultural (agriculture, biomass, livestock, aquaculture, fisheries, water and forests) and energy (transport, industry, energy, buildings, waste management) sectors. It requires the setting up of a measuring, reporting and verification (MRV) system to monitor these measures.
- The Modern Villages Programme (PROVIM) and the development of Rural Energy Services: This program plans to provide access to electricity to each village with a viable waterway. The program plans to build mini-power plants to produce electricity. The program relies on the involvement of governors in implementing the on-going projects. The supervision is made through public operators such as SNEL and REGIDESO, and the new agency on rural energy services, ANSER, created with the new law on electricity.

It is in this context that is developed the project of support to the promotion of mini- and micro-hydropower plants in the DRC. It participates in the national commitment to accelerate the implementation of the rural electrification policy and to promote clean energy, and fits in perfectly with the national policies and strategies in progress, in addition to the previous or existing projects.

2.4. Analysis of stakeholders in DRC

The energy sector is covering many issues. It involves a large number of stakeholders, such as i) governmental institutions and affiliates, ii) key players in the private sector, iii) technical, professionals, academic and/or scientific institutes, iv) partners from the civil society, and v) provincial representatives and local communities. All these stakeholders were consulted in August and September 2014.

Institutional stakeholders

The Ministry of Energy and Hydraulic Resource (MERH) is responsible for the design, implementation and regulation on the national energy policy. His mandate covers the management of DRC's energy resources, including renewable energy, and of electrification in both urban and rural areas. The ministry was involved in DRC's Renewable Energy Atlas previously mentioned, particularly through the National Energy Commission (*Commission Nationale de l'Energie/CNE*).

The MERH is the main implementing partner of the project, particularly the Department of Electricity.

The National Energy Commission (CNE) is a consultative body under the supervision of the MERH. It has headquarters in Kinshasa as well as provincial offices. CNE is responsible for the definition of the energy policy and its update. Therefore, it manages the energy database that includes balance sheets and energy indicators from which it implements consistent and efficient energy strategies. CNE also conducts laboratory testing of new technologies, inventories potential sites and undertakes pre-feasibility studies of small scale hydropower plants (and other energy sources) for the benefit of the Provinces. It also promotes rural electrification.

A complementary structure to CNE, the Technical Support Unit for Energy (Cellule d'Appui Technique à l'Énergie/CATE) is, as its name suggests, a technical support to the MERH. It strengthens the capacities of the administration and of energy-related public companies through the following tasks:

- Analysis and coordination of the presentation to bilateral and multilateral donors of investment projects and programs ;
- Monitoring and definition of medium and long term sectoral strategies ;
- Contribution to the technical and financial arrangements of projects in the fields of water and electricity,
- Sectoral coordination of energy projects or investment programs with bilateral and multilateral donors under the MERH.

The Ministry of Environment and Sustainable Development (MEDD)¹⁸ is responsible for the implementation of national policies for the sustainable management of the environment and for the preservation of biodiversity and ecosystems. This includes the fight against climate change through the Climate Change and Energy Division. MEDD develops a national green growth strategy, which includes climate change mitigation and adaptation strategies.

As the GEF Focal Point¹⁹, MEDD is the structure that receives GEF funds dedicated to projects. In the case of the project promoting MHPP, these funds will be partly allocated to MEHR.

The Ministry of Agriculture and Rural Development (MADR) is responsible for the design and implementation of policies related to the rural sector in DRC. The ministry's mandate covers not only agricultural production, but also the sustainable development of the rural sector and the population's access to basic social services, in line with the Millennium Development Goals (MDG). MADR is thus also concerned with rural electrification, alongside MERH and the Ministry of Public Works.

As a matter of fact, MADR hosts a New and Renewable Energy Unit (Service National des Énergies Nouvelles et Renouvelables/SENEN) responsible for promoting rural electrification and access to renewable energy (small hydro, wind, solar, biogas, etc) and energy efficiency (improved cook-stoves).

The Rural Electrification Agency (ANSER) aims to encourage the supply of electricity in rural and poorly urbanized areas. It supports the participation of the private sector in electrification projects,

¹⁸ <http://www.mecnt.gouv.cd/>

¹⁹ http://www.thegef.org/gef/focal_points_list/C

and is responsible to integrate and coordinate public and private stakeholders in rural electrification. More details on its creation and purpose are given in the section below.

The Ministry of Finance is under the supervision of the Prime Minister. It is the executive branch of the Government responsible for public finances. It plays an important role in the promotion of private investment and public investment.

Other ministries are indirectly involved in the project, namely the Ministry of Scientific Research and Technology, the Ministry of Higher Education and University, the Ministry of Economy, the Ministry of Planning, the Ministry of Small and Medium Size Enterprises, and the Ministry of Communication and Education to the new Citizenship.

The Central Bank of Congo²⁰ is in charge of DRC's monetary policy. It is in relation with credit institutions, micro-finance institutions and with many financial intermediaries. Its contribution to the success of the national SE4ALL agenda is expected, as it is the only public financial institution that can respond to the issue of bank and loan guarantees for investments to be made in small hydraulic structures.

Private sector and financial institutions

Investment opportunities in the energy sector, especially for the development of MHPP, are of interest for many private partners. Examples of private organizations that have invested in the development of MHPP have been identified, for instance the micro-hydropower plant in Katana supplying the Medical Foundation of the University of Louvain in Central Africa (FOMULAC) and its hospital. The review of the private sector covers the main companies in the power sector and private financial institutions.

The National Electricity Company (Société Nationale d'Électricité/SNEL)²¹ is a private company whose sole shareholder is the Congolese State. It is responsible for the generation, transmission, distribution and marketing of electricity in DRC. It runs power plants for a total installed capacity of 2,443 MW in 2013, 99% being hydro, and 1% thermal. In addition, SNEL manages a grid of more than 16,000 km.

Electricity of Congo (Électricité du Congo/EDC)²² is a company specialized in the production and distribution of renewable energy. EDC develops and manages the Tshikapa (10MW), Katende and Busanga hydropower plants.

The Federation of Congolese Enterprises (Fédération des Entreprises du Congo/FEC)²³ is the largest business organization in DRC. It has an Energy Commission, responsible for dealing with energy issues in a holistic approach. Its mission is to lobby for a better business environment, providing its members with information and assistance on the opportunities and conditions for investment success. For FEC, the project is ranked as very important to support a number of industrial sectors in the country, by increasing power supply.

²⁰ <http://www.bcc.cd/>

²¹ <http://www.snel.cd/>

²² <http://www.edc-rdc.com/>

²³ <http://www.fec.cd/>

The Confederation of Small and Medium Enterprises of Congo (*Confédération des Petites et Moyennes Entreprises du Congo/COPEMECO*) is also a major business organization in DRC, dedicated to small and medium size enterprises (SME). It gathers SME and small industries in a confederation in order to support its members and defend their interests.

Helios Towers DRC²⁴, a telecommunication company, manages the vast majority of telecommunications towers and antennas in DRC. These towers require to be supplied by power, most of them in remote locations. The project can help meet growing demand in electricity from mobile phone operators.

The private banking sector has a role to play as a financial intermediary for investment in mini- and micro-hydro. Institutions in the banking sector through financial products such as green loans can catalyze investment in renewable energy sources, first and foremost for the development of MHPP.

Technical, professional and academic institutions

The Polytechnic Faculty of Kinshasa, which is one of the 12 faculties of the University of Kinshasa (UNIKIN)²⁵. It trains civil engineers specialized in the design and engineering in various sectors such as construction, engineering, mining, metallurgy, chemical industry, etc. Electricity is one of the most important sectors.

The Institute for Applied Technologies (*Institut Supérieur des Techniques Appliquées/ISTA*)²⁶ trains senior technical staff to become industrial engineers. Courses are provided in various sections, including a section on electricity, for two different degrees.

The National Institute for Building and Civil Engineering Works (*Institut National des Bâtiment et des Travaux Publics/INBTP*)²⁷ trains engineers in the field of construction, and prepares them to design and supervise large construction projects.

The National Institute of Professional Preparation (*Institut National de Préparation Professionnelle/INPP*)²⁸ provides vocational training in many different technical fields. The institute was launched in June 1964, in the aftermath of the independence of DRC to help the national industry to solve the problems posed by the fact that many foreign technicians and managers had left the country. INPP has the status of a public institution with a technical and social mandate, a legal personality and an administrative and financial autonomy since 2009. It is under the Ministry of Employment, Labour and Social Welfare and has offices in different provinces.

All the provincial capital cities have established institutions for technical and vocational education, training A2 and A3 level technicians. The subjects taught are generally electricity, construction, carpentry, mechanical engineering and mechanics for the automotive sector. These provincial antennas do have limited resources and are poorly equipped, and the project will support them in

²⁴ <http://www.htdrc.com/>

²⁵ <http://www.unikin.cd/>

²⁶ <http://www.ista.ac.cd/>

²⁷ <http://www.inbtp.cd/>

²⁸ <http://www.inpp.cd/>

that respect, for them to play a key role in the capacity building component, in order to produce technicians to meet the needs and enable the development of MHPP.

Civil society organizations (CSO)

The civil society has certainly an important role in the development and the financing of MHPP. For example, many micro-hydropower plants exist in South Kivu, under the initiative of the Catholic Church (micro-hydropower plant of Cibimbi) and of local associations and communities (micro-hydropower plant of Mushunva and Burhinyi).

Among the international NGOs active in DRC in rural areas, there is IRC (Innovative Rescue Committee) which can be a good partner for the promotion of MHPP in the country.

Provincial and local institutions

Provinces of DRC have their own executive system and their own administrations. National administrations do also have branches that have the same power at the province level, subject to constitutional provisions allocating power to different areas of the state.

Provinces have a crucial role to play on the access to funds, and the use of water streams.

This requires an awareness of the provincial authorities about the opportunity to develop MHPP. Particular attention should be paid to the relationship between project leaders and provincial and local institutions, so that they facilitate and assist project managers in their efforts.

Technical and financial partners

Many bilateral and multilateral partners are involved in the financing of micro-hydro projects in DRC. The main ones are listed below.

The Department for International Development (DFID) of the United Kingdom, in DRC since 2001, is interested in the promotion of hydro-electricity. It supports a program called Elan RDC²⁹ oriented towards supporting the development of a marketed approach, including the electricity market. One of the sectors of activity of Elan DRC program is micro-hydropower. It revolves around three modifications of market making concessions easier to obtain, making information on investment and potential returns available, and ensure that appropriate financial products are available to potential investors.

The Japan International Cooperation Agency³⁰, better know under the acronym coordinates official development assistance from Japan. The current organization was founded on October 1, 2003 in accordance with project defined by the law on independent government agency national cooperation in 2002. Accessed on its interest to support the field of micro- and mini-HDRO electricity DRC has expressed an interest in showing that its geographical scope was limited to the neighboring provinces of the capital.

²⁹ <http://elanrdc.com/>

³⁰ <http://www.jica.go.jp/drc/english/>

The German cooperation in its general appellation encompasses the GIZ and KfW, the first body being technical while the second is financial. German cooperation in the DRC target the following areas of investment: access to drinking water and sanitation water, protection and sustainable use of natural resources and the establishment and development of a system microfinance throughout the DRC.

The Wallonia-Brussels Delegation in Kinshasa³¹ ensures the diplomatic representation of Wallonia-Brussels Democratic Republic of Congo. She is ready to offer its assistance to national authorities in strengthening their capacities in the field of hydro power on a small scale and for a favorable environment for private investment in the energy sector economic environment.

Cooperation with the European Union³² is old, since it dates back to 1959, making the European Commission one of the largest donors to the DRC. The donor has funded several projects of little small hydro (1 MW or more), targeting two Kivu, Katanga and the Eastern Province.

The Netherlands Development Agency (SNV)³³ is very active in the renewable energy sector in the DRC. She has co-financed many activities, in partnership with UNDP, such as the Renewable Energy Atlas or the Forum on Renewable Energy Development (Forum sur le Développement des Energies Renouvelables/FoDER).

The Korean International Cooperation Agency (KOICA)³⁴ is present in DRC since 2009. It has helped to fund the project community recovery and consolidation of peace in North Kivu, three-year project which started in 2011. The project aims in particular to rehabilitate and / or build microdams for electricity production and reducing the use of charcoal.

The World Bank is active in DRC to finance the large scale hydropower projects. In 2014, the institution started a new mid-size hydropower development project for Inga 3. The objective of this project is to contribute to the sustainable development of Inga 3 Basse Chute (BC) and selected mid-size hydropower projects. There are two components to the project, the first component being Inga 3 BC development support. This component will build on the feasibility study for the development of the Inga site and associated interconnections financed in 2010-13 by the African Development Bank³⁵.

The African Development Bank (AfDB) is also involved in hydropower, and more generally, in the power sector. It is the case with the 68 millions USD project called PASEL for “*projet d’appui au développement du secteur de l’électricité*”. This project will finalize the preparation of the first phase of the Grand Inga Hydropower Project, called the Inga 3 Project, which will consist of developing a power-generating capacity of 4,800 MW on the Inga site and building power transmission lines that will supply electricity to DRC and to the Republic of South Africa.

2.5. Synergies

There are several initiatives in progress and plans for on-grid and off-grid energy services to cover not only the densely populated areas (with the huge hydroelectric power plants), but also rural

³¹ <http://www.wbi.be/fr/kinshasa>

³² http://www.eeas.europa.eu/delegations/congo_kinshasa

³³ <http://www.snvworld.org/en/countries/dr-congo>

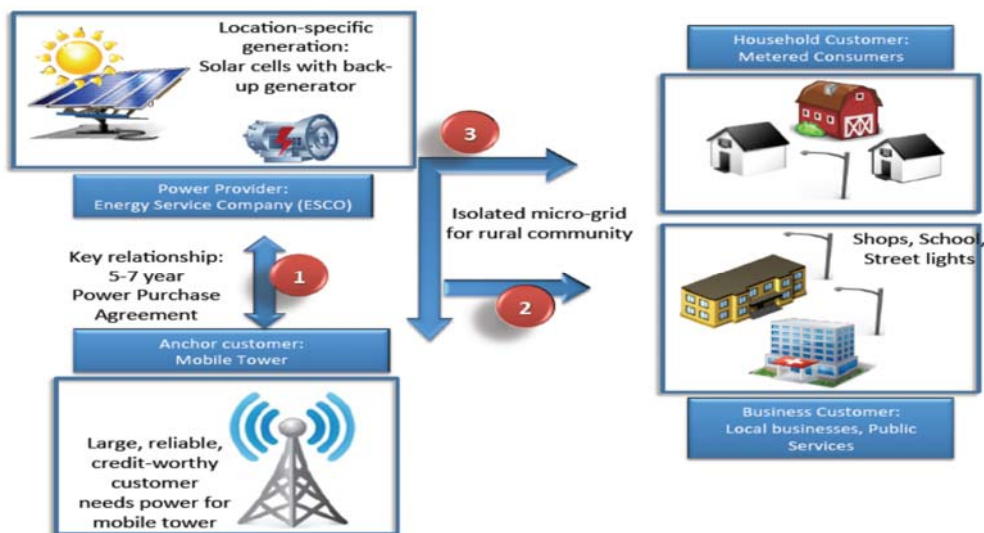
³⁴ <http://www.koica.go.kr/english/main.html>

³⁵ <http://www.worldbank.org/projects/P131027/inga-3-development-ta?lang=en>

areas. This section inventories existing or forthcoming initiatives where synergies with the project are recommended.

The Telecom-Energy Initiative³⁶: This scheme is an initiative of the World Bank which principle is to link rural electrification and power supply to telecom towers. The idea is to enable private sector involvement in the rural electrification process through power purchase agreements between private energy service companies (ESCOs) and telecom companies who need energy for their telecom towers in order to allow them to access to finance. The scheme will allow ESCOs access to banks for financing thereby creating an easier environment to carry out their business.

Graph 3: Intervention approach of the Telecom-Energy Initiative



ESCOs can then also supply electricity to local communities which is the main purpose of the scheme. The specificity of this proposed initiative is the creation of community-based ESCOs. As opposed to a private company, in this scheme, the ESCOs will take the form of renewable energy cooperatives. These cooperatives will then lead to a system electrification designed, managed and operated by the local community. It is important to note that 1) financial access, 2) technical support and 3) legal and regulatory framework are integral to make the system function. Energy supply to telecom towers will enable the cooperatives to access to finance. A microfinance scheme will be introduced for the lower implementation costs.

There are currently four mobile operators collaborating with banks in DRC: Vodacom, Tigo, Airtel and Africelle. Many of them rent their telecom towers from the company called Helios Tower. Helios tower provide not only the tower itself but also electricity to operate the tower and they have already shown their interest joining the proposed project.

A telecom tower requires continuing power supply, with a system capacity between 500 and 2,000 W. In terms of consumption, the needs vary between 14 to 48 kWh per day.

³⁶ <http://wbi.worldbank.org/wbi/connect/telecom-energy-initiative-online-collaborative-platform>

The EU Energy Initiative Partnership Dialogue Facility (EUEI PDF)³⁷: This facility aims at providing a technical assistance to the creation of the national agency for rural energy services (ANSER) in DRC. A scoping mission³⁸ took place in 2013, which resulted in recommendations to set up a Working Group by the MERH, in view of preparing the establishment of the ANSER.

The initiative enable to identify stakeholders likely to participate in the ANSER, including institutional partners and potential project sponsors. This initiative can be of use to the MHPP project, since it details various stakeholders' views and interests on rural electrification.

The necessity to organize the MERH was pointed out so as to strengthen communication and cooperation between units and with other ministries, to clarify roles and to get better results.

However, the initiative will address administrative delays, financial management issues, and lack of capacity of the project developers themselves. Specific challenges to DRC are the size of the country and, as a consequence, the potential logistical difficulties.

A working group dedicated to the creation of ANSER is supported by EUEI PDF, including an interministerial consultative committee and technical assistance.

2.6. Capacity building needs

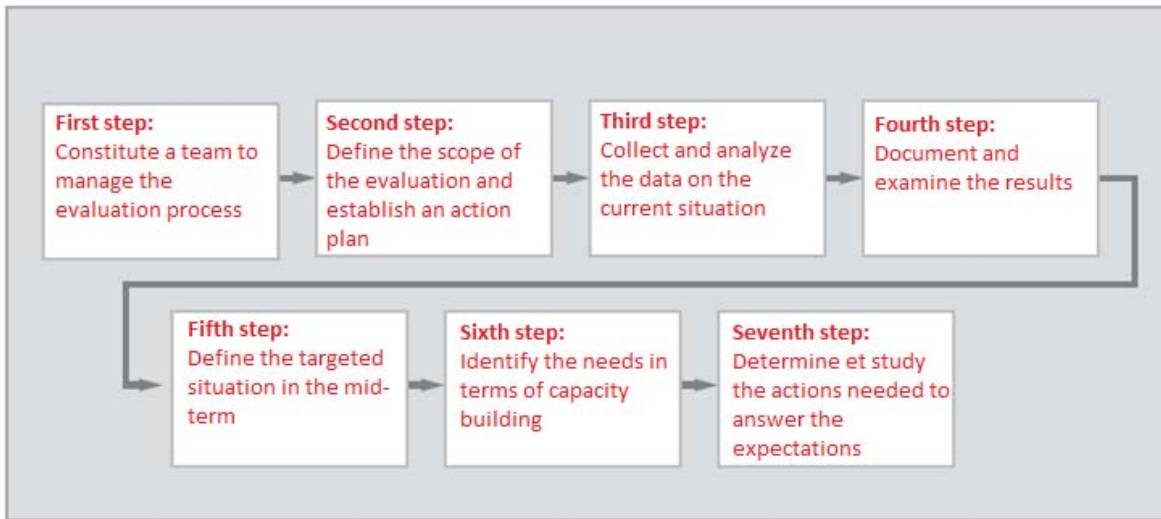
Capacity building is an essential aspect of the project, first on the technical, but also legal and financial. This is firstly to make available to community organizations that express a need, ad hoc expertise and national or international level in the field of hydro-electricity from small scale. On the other hand, it should support the organization of training, information and exchange of experiences in the area of civil society and support them in supporting the Board, communication and exchange of good practices in MHPP.

The project beneficiaries are encouraged to ask questions related to their needs, at various levels, including the national sectoral level (knowledge of the mechanisms of institutional decision at the provincial level, etc. policies of hydro- electricity), organizational and strategic (main difficulties or constraints in organizational terms, the existence of appropriate tools in strategic planning, action plan, etc.), management and monitoring and evaluation (appropriate management tools such as a procedures manual, M&E plan, etc.).

Table 5: Steps for capacity building assessment

³⁷ <http://www.euei-pdf.org/>

³⁸ http://www.euei-pdf.org/sites/default/files/files/field_pblctn_file/EUEI%20PDF_DRC_Support%20of%20a%20new%20Rural%20Electrification%20Agency_Scoping%20Mission%20report_11102013_FR.pdf



3. Objectives of the project, results and activities

The newness of the MHPP within the power sector requires specific efforts to its promotion and appropriation. Indeed, structures, communications companies, education and laws that exist in the electricity sector have given some attention to the promotion of investment and activities in the field of MHPP. For instance, the new law on the electricity sector addresses MHPP, but does not provide specific measures to promote investment for the development of small scale hydropower. At the same time, with the implementation of the new law, special attention should be placed on the importance and the need to integrate mini- and micro-hydropower systems in line with the national SE4ALL programs and strategy.

With the project, MHPP will be supported with regulatory enforcement in the new national energy policy, structures and mechanisms responsible for the sensitization and mobilization of local and foreign partners. Sites will be prioritized and developed to increase the number of MHPP in DRC and the share of renewable energy in the energy mix in rural areas. This will have indirect impacts on the fight against poverty and mitigate rural exodus, increase the financial and economic profitability of power generation, create jobs, and decrease the pressure on forests.

3.1. Project objective

The project aims to contribute to improved access to affordable and reliable energy services, energy security and the fight against climate change. It will thus contribute to the emergence of a favorable environment for hydropower investments, favoring the development of mini- and micro-hydropower.

Through the project, the share of mini- and micro-hydropower will increase in the energy mix of DRC. The choice to develop MHPP is based on technical, economic, financial and legal criteria and the project will contribute to the national strategy SE4ALL. The project responds specifically to the outcome of improving the energy mix positive eco-balance, i.e. "increasing the share of new and renewable energy from 2.4% in 2010 to 30% in 2030" (Outcome 7). It contributes significantly to the implementation of the national program for the promotion of new and renewable energy sub-program for the development of small and micro hydro.

3.2. Project Outcomes

The first outcome of the project is to reinforce the new regulatory and institutional framework, in order to promote private and community-based investment in the development and operation of small-scale hydropower systems.

The second outcome of the project to strengthen the technical capacity at national, provincial and community levels, in relation to the MHP supply chain, i.e. covering domains such as manufacturing, equipments, engineering for MHPP development, MHPP construction skills, O&M, finance, legal aspects, etc.

The third outcome is to provide power from a few pilot MHPP in rural areas, which will serve as demonstrators. The target is to reach an increased installed capacity of 10 MW from new or rehabilitated MHPP.

The fourth outcome is to raise awareness to bring more private and community-based investments. Each component is designed to reach its related outcome.

3.3. Expected results

At the end of the project, DRC will have consolidated and further developed its new legal, regulatory and institutional framework, and private investors will be more incentivized to develop new MHPP in rural areas. At the same time, the country will have trained a significant number of new workers, engineers, technicians, financial and legal experts in the energy sector, so that the sustainability of the small-scale hydropower generation is improved.

In terms of energy access in rural areas, the project will have contributed to a 50% increase of the installed capacity of MHPP, from 20 MW to 30 MW. 39 new or rehabilitated pilot MHPP will be running.

Finally, the financing of MHPP is facilitated as a result of the project with growing financial flow towards small scale hydropower systems.

To address the project's objectives and achieve the expected results, the project framework is structured along 4 outcomes or components.

3.4. Project Outcomes, Outputs and Activities

The project has been designed to implement four components that are expected to generate outputs that, when achieved, will realize the general and specific project objectives.

Component 1. Policies and a regulatory and institutional framework for private and community-based investments in mini grids supplied by small scale hydropower

The Outcome will be that the development of policies and a regulatory and institutional framework for small grids supplied by mini and micro hydropower and the financial viability of these mini networks are in place and operational.

The realization of MHPP through the management of the sector on the legal, regulatory and financial and policy framework leads to the following results:

- increase in access to electricity in rural and urban populations per rate;
- increased investment in the sector with the creation of funds guaranteed by the Government and / or development partners;
- increase in household income and any investor in the sector;
- increase in economic efficiency in rural areas through the establishment of industrial economic activity and transformation;
- competitiveness in the energy sector, source development;
- GHG reduction followed by an increase in the sequestration capacity of DRC.

It is the beginning of a new era with the political commitment to the energy sector. The new law governing the electricity sector appears relevant and constitutes an attractive legal framework. It liberalizes the market to private enterprise and opens competition, and it recognizes the right of access to electricity to all Congolese citizens. Still, this is an early high-level commitment in response to the national problem of universal access to electricity. This new environment is a step that dictates the direction of the national policy of electricity, on which projects will have to be built

in the future. Only experience will justify the importance given to it and guarantee the success of this new regulatory environment.

Profound changes are expected in the energy sector. This calls for a systematic and multi-sectoral support of the implementation of the new law, which will normally be in front of all activities that follow.

The rapid production of measures to implement the new law are needed: the regulatory side, about 7 ministerial orders and decrees 8 discussed in the Council of Ministers must be taken for the implementation of the law in question. So, having in mind the results to be achieved under SE4ALL initiative, efforts should be concentrated to the enactment, without delay, of the proper measures, without which the development of the sector effects will be delayed.

DRC has experienced in its history, laws in force, but that remained unimplemented, with fell into disuse by the absence of implementing measures. In the case of the energy law, it is important to support it by national agency cooperation programs, including institutional support measures provided as to be put in place at the beginning not long after arriving, while the cooperation project itself coming to an end.

The operationalization of the new institutional framework is a critical step. In terms of the institutional framework, responsibilities are now shared between the Central Government, the Provinces, the regulator of the electricity sector and the public institution in charge of financing and promotion of rural electrification. This somehow solves the famous issues of guardianship, proximity and accessibility of services vis-à-vis users. However, efforts must continue and lead to the enactment of all law enforcement, its extension, and the operationalization of the institutional framework over the entire national territory.

This outcome will participate to the adoption of the national policy on electricity and other normative documents which are mentioned in the law but not existing. The production of texts in favor of the promotion of MHP is part of this outcome. Special measures will prove vital in order to monitor, stimulate and support the production process of regulatory texts to promote MHP.

For instance, the new law has not arranged in a special way for MHP, and substantive work should be undertaken to ensure the inclusion of various parameters to give it a privileged treatment. Without an incentive, it will be difficult to attract private capital and ensure the achievement of national goals for access to energy for all. Accompanying the actors and stakeholders from all sectors and at all stages of the process will be a factor of success.

Output 1.1. An institutional and regulatory framework for rural electrification by MHP is set up

This output consists in the establishment of the institutional framework and the enactment of any application of the law of the electricity sector. Article 87 of the law n°14/011 from June 17, 2014 states that "the institutional framework for the electricity sector in DRC includes the central Government, Provinces, the Regulatory Authority of the electricity sector, public institutions in charge of the promotion and financing of rural electrification".

Institutions such as the "central Government" and "Provinces" are to be strengthen on energy to enable them to fulfill their mandate vis-à-vis the industry. "Province" means the Provincial Government and the decentralized governmental entities.

The situation is different with the Regulatory Authority of the electricity sector, and the public institution in charge of the promotion and financing of rural electrification, since these two entities are new. They will have to first establish and then be supported in their deployment in the provinces. These entities are important in the context of the promotion of MHP.

Activity 1.1.1. The institutional framework (national and provincial levels) and the Regulatory Agency of the electricity sector are strengthened, with the following actions.

1.1.1.1. Identification of the capacity building needs of the MERH: The new law on electricity sector strengthens the role of the MERH with all matters relating to the electricity sector being under his mandate, including the promoting of rural electrification and related establishments. This implies therefore some needs, and additional organizational facilities to effectively fulfill its mission. The MERH will be responsible for reorganizing and thus revive a fragile sector, this in a huge country like DRC, with vast isolated rural areas, where very little is known regarding the regulation. Thus, it requires prior identification of departmental needs that will have to be strengthened in order to focus efforts to areas directly related to the achievement of the project results.

1.1.1.2. Identification of the capacity building needs of the Provincial Departments in charge of electricity: Capacity building needs in provincial departments in charge of electricity will be addressed under this activity. Provincial Ministries in charge of electricity are also found in a similar position to the central Government: their role is reinforced by the law of the electricity sector, by resources are lacking. Coaching, monitoring, control and support of MHPP developers and operators should be made possible if resources from the Congolese State are mobilized. The context in which provincial governments operate is ambivalent, some provincial governments are relatively equipped in management tools and do have financial resources compared to others. Hence there is a gap between rich and poor provinces. It requires prior identification of the needs of the departments in the provinces lacking of resources, to enable them to take actions properly.

1.1.1.3. Organization of provincial workshops as an extension of the law of June 17, 2014 with agents from the decentralized administration involved in the electricity sector. The law organizing the electricity sector was promulgated on 17 June 2014. During the consultation phase of the project stakeholders during the months of August and September 2014, it was clear, in all provinces, that awareness was needed about the content of the new law. Most actors unfortunately were not yet aware of the consequences of the new regulatory framework. In this context, the decentralized administration (Provincial Division for electricity, CNE, etc.) do not match economic operators, potential investors and developers expectations. Workshops will be organized in each provincial capital to target key players in the industry. The workshops will provide them with relevant and accurate information about the content and consequences of the new law. The purpose of this activity will not only be informative sharing but also promotion of the MHPP sector, the aim being to bring the best possible players to be involved in MHP.

1.1.1.4. Organization of national workshops about the new law, targeting operators, including electricity directions, etc. At the national level, information workshops will be organized but more leaning towards the owners of capital, such as banks, FEC members, private sector key players, telecommunications companies, religious organizations, bilateral and multilateral donors, NGOs, etc. to initiate a real debate on the increasing opportunities to invest in or intervene in the sector, especially MHP. The public sector will be invited as well, for a larger appropriation of the law and its components. Fiscal issues and customs aspects will be covered.

1.1.1.5. Capacity building of the Electricity Directorate of the MERH in software and hardware equipments. With the establishment and operationalization of the new institutional framework, an increase in the flow of information and data is expected. An allocation to the Electricity Department of the MERH supplying office equipments is a warranty to increase, among others, efficiency, fluidity and easy dissemination of information to various stakeholders.

1.1.1.6. Capacity building of Provincial Departments in charge of electricity in computer equipment, office equipment and supplies. The same observation is made with respect to the Provincial Ministries in charge of electricity. With the gradual development of MHP, as well as the implementation of the Law of the electricity sector, an increased flow of information and data is expected. Software and hardware equipments will guarantee the management of provincial MHP databases and fluid information for a better supervision of the sector.

1.1.1.7. Identification of existing and potential developers of MHPP per site per province. It is important to keep and nurture a dynamic database by province and nationally. This will enable a better overview of the development of MHPP in the sector. This will facilitate communication of the data with both the State and international partners whenever there is a need.

1.1.1.8. Organization of workshops for MHPP developers about the application of the new law. This activity may be held separately or inserted in similar workshops planned under other components. It aims to better inform MHPP developers on cross-cutting issues related to the sub-sector and to make them aware of the potential of the sector, as well as ways and means to enable them to maximize their investments. It is also a forum to share information about the industry with other provinces and in other places.

Activity 1.1.2. Support the establishment and operationalization of the Public Entity in charge of the regulation and the one in charge of the promotion of renewable energy in rural areas, for both national and provincial levels.

Under this activity, the following public establishments will be created under the jurisdiction of the MERH, who will have to make a legislative proposal to the Central Government:

- The Regulatory Authority of Rural Electrification (ANRE);
- The Public Establishment of Finance and Promotion of Rural Electrification (ANSER).

They will be responsible for the regulation and the promotion of renewable energy in rural areas. They will be deployed both at the national level (in Kinshasa) and in the provinces.

This process will be supported by an appointed consultant, in order to overcome the risk of long, slow and complicated administrative proceedings, and to ensure that there is a proper coordination of actions between the two entities and with public institutions. The project will also support this implementation by addressing the needs of the two institutions in terms of equipment and material.

Once established and made functional, these two facilities will be effective interfaces between the project and the beneficiary communities. They will issue manuals, guides, and other normative documents on the electricity sector, according to the tasks described in articles 94 and 96 of the Law of the electricity sector. In particular, these two articles set the specifications for the award of concessions and specific licenses, the establishment of records, tenders, etc. and of any normative document in the public service of electricity. The two Public Entities will determine and monitor the price structure, and set tariffs in the sector. The project will therefore need to ensure the maximum possible support to the institutions, not only for the setting-up of the normative

documents under their jurisdiction, but also to ensure that these documents are widely disseminated to third parties.

To guarantee this dissemination, the project will launch a vulgarisation campaign for the normative documents. Popularizing the documents produced will allow the new institutions to integrate in the communities and to effectively provide the services they are assigned by the law: to provide information, regulation and warnings on rural electricity and renewable energy.

Activity 1.1.3. Establishment and operationalization of Electrification and Development Local Committees (CLED) in the pilot sites.

Rural communities often possess their own unique dynamic. They know better than anyone how to organize and take care of themselves. Members of a community can collaborate together to produce works of common interest, and efficiently achieve both individual and community goals. The project can take advantage of good practices already existing in communities all over the country in order to get better recovery rates of electricity bills, and to improve socio-economic indicators in the pilot sites. These practices (tontines for the payment of electricity bills, community intermediaries for the payment of bills, co-consumption of electrical energy...) will encourage investors.

The project will promote the development of Local Electrification and Development Committees (CLED), in the defined pilot sites and in other sites where MHPP initiatives arise. These Committees will be responsible for the adoption, when possible, of a community approach in solving problems related to the electricity sector (complaints, outages, billings, etc.). Once established, CLED can become true frameworks between the consumers, and between consumers and producers. In the medium and long-term, they can become auxiliaries between the Regulatory Authority/the Funding Establishment and the MHPP sites. Indeed, due to the size of the Congolese territory, most of these sites will be relatively remote from institutions.

The CLED will also discuss the new development opportunities which will be offered by the proximity of electrical energy (small agro-processing, juicing, light canning, modern drying of fish or meat, etc.).

The setting up and launching process of the CLED will be supported by an appropriate consultancy. The consultant will provide adequate legal definition to CLED through the writing of TOR, and accompany CLED's development, installation and functioning until they reach the desired maturity.

CLED should be launched as soon as possible in all MHPP pilot sites. Indeed, they will contribute to the educational and demonstrative value of the pilot sites by improving the management of MHPP indicators. CLED members will be members of the community, since the project is developed primarily for their own benefit and development.

The CLED will be led by a director elected by the members of the community committee. The steering committee members will have a limited mandate and rotary, according to the law on non-profit associations. They may be from the public sector, private sector, religious communities, Non-Profit Associations, etc.

It is expected that with the development of MHPP, issues related to electricity will become increasingly complex, with for example new business opportunities being given to the population. CLED members will thus receive appropriate trainings and capacity building which will help them

provide maximum support to their communities and strengthen their development. Training subjects can range from conflict management, to rural organization and animation. Synergies will be developed with donors who wish to intervene in the sector and will get advice from CLED members.

Activity 1.1.4. Support the development of regulations implementing the law of the electricity sector

Elaboration of these documents will be supported by a consultancy. It seems an appropriate solution that the appointed consultancy will be the same as the one supporting the setting-up of the two Regulation and Financing Entities. This consultancy will keep the same objective as the previous one, which is to save time by closely monitoring and stimulating the action of the government bodies in charge of the legislation.

Ad hoc Ministerial and Inter Ministerial Commissions (CM and CIM) will be set up to develop the regulations, under the supervision of the consultancy. Workshops will be organized, dedicated to the elaboration of the texts. The project will provide a logistical and financial support to these workshops through the reimbursement of travel expenses, office supplies, catering costs, accommodation costs if necessary, and other expenses complying to UNDP's rules of use. This support will allow the teams constituting the committees to accomplish their work as soon as possible. The same will be done for the text validation workshops: support will be provided by the project in terms of reimbursement of travel expenses, office supplies, restoration costs, and other expenses under the UNDP rules of use.

Ideally, the texts will be developed and produced in a relatively short space of time. The consultancy support will ensure that this is the case, as far as possible. This would facilitate outreach to stakeholders in the capital and throughout the provinces. The project will organize at least one dissemination workshop by province, one by pilot site and one at a national level.

Activity 1.1.5. Support the development of normative acts of the Regulatory Authority and those of the Public Establishment promoting Rural and Periurban Electrification

The Law³⁹ defines that the Regulatory Authority of the electricity sector's missions include, among others: 1. promoting competition and private sector participation in the production, transport, import export distribution, and marketing of electric power in the conditions laid down by law; 2. ensuring compliance of operators in the sector of the conditions of implementation of concession contracts, licenses and permits; 3. ensuring third party access to the electricity transmission network, within the available capacity; 4. monitoring the enforcement of standards and norms by operators and developers of the electricity sector; 5. establishing the specifications for the allocation of specific concessions and licenses, and any normative document in the electric public service, alone or in collaboration with third parties in accordance with the provisions relating to the award of public contracts; 6. conducting preliminary conciliation of disputes between operators on the one hand, and between operators and consumers on the other hand, in the electricity sector, before entering any justice; 7. Identifying and monitoring components of the price structure on the basis of which the ministries in charge of the national economy and the one in charge of electricity will set the electricity prices for final consumers; 8. proposing to the ministries in charge

³⁹ Article 94 of law no 14/011 of June 17, 2014 on the Electricity sector in DRC

of the national economy and the one in charge of the electricity the producer price, and the price for the use of transmission and distribution grids on the basis of the cost provided by the operators.

It is therefore imperative to ensure its implementation and its deployment throughout the territory of the Republic (in the capitals of the provinces in particular) so as not to lead to an institutional gridlock that would result in blocking sector and project activities.

It is the same with the public institution in charge of the promotion and financing of electrification, which is responsible for⁴⁰: 1. collecting and disposing of inventories and data on national energy potential; 2. developing the national rural and peri urban electrification plan to integrate into the national electrification plan; 3. establishing a multi-year implementation program for this plan; 4. promoting electrification in rural and peri-urban areas through technical and financial support to public and private initiatives; 5. establishing the bidding documents and procedural procurement in accordance with the law for services, supplies and works required for this purpose; 6. supporting the development of electrification projects through the stimulation of local initiative on the conceptual and technical level, the mobilization of funding and the presentation of various services; 7. seeking funding and monitoring relationships with donors and instruction.

The project thus gives priority to supporting i) the development, ii) the deployment in all provinces, and iii) the operationalization of these two Institutions, because once operational, the two will be key partners to achieve the project objectives.

Workshops / forums / literature reviews, etc. will be planned and organized by both institutions, once set up, to develop their different normative documents. Given the binding nature of its budget, the project will be limited to supporting workshops during the phases of text development.

MHP being a new subject, it will be implemented on the basis of new legal texts, in rural areas, with new institutions with new powers, etc. It will be more appropriate that the texts are disseminated, whenever feasible, through illustrated versions. This will facilitate understanding. The more users understand the normative texts, the better they will enforce and apply them, and the better these texts will have the chance to achieve the purpose for which they were enacted.

Vulgarisation workshops for the texts will be organized with stakeholders at national and provincial level. These workshops will be an opportunity for stakeholders to assimilate the content of these texts and get familiar with it. The workshops will be designed as forums for exchange between participants and facilitators to ensure that any questions of any of them are addressed. In this context, the media will be made available to participants a few days before to encourage their interaction.

Vulgarisation workshops will also be organized in the CLED, targeted because of their community basis. The more leaders and influential members of the committees will have appropriated the contents of the texts, the more they will be able to transmit and spread them to other members of the community.

Activity 1.1.6. Launch a national diagnostic study on Legal, Fiscal and Administrative system of MHPP sector in the DRC.

⁴⁰ Article 96 of law no 14/011 of June 17, 2014 on the Electricity sector in DRC

The constitution of February 18, 2006 recognizes to different state bodies the power to legislate and establish rules and standards of general scope compared to their jurisdictions: Therefore, several legal texts emanating from these are currently used, and sometimes evolve divergently. With the development of MHP, the problem will get worse if corrective preventive measures are not taken beforehand. It is in this context that we need to inventory, identify, harmonize and coordinate the administrative, legal and fiscal regulations in force governing the electricity sector, and that at a provincial, then national level. The study will identify any inconsistencies, overlapping, jurisdictional disputes, interference, etc. that might disturb the harmonious development of the sector. At the consultation stage of provincial stakeholders, we found repealed regulations that were still enforced either by ignorance or purposely, and that were simply faith and law.

As an administrative, financial and operational preliminary for the study, Terms of reference will be written. They will provide guidelines for the design and the intervention logic of the activity. A consultant will then be recruited to conduct the study. The work being of a high legal scope, the project and its partners will use the services of a consultant to conduct the study. It may as well be under the care of a consulting firm that will handle the same mission as the consultant.

The project will support the implementation of the study, which will cover the entire national territory. Its conclusions, as said above, will help correct / fill in an informed manner the gaps identified.

Finally, the study will be published during a workshop, which will involve all the sectors concerned closely or loosely by the issues: fiscal and para fiscal services, MHP developers, public sector, private sector, potential investors, etc.

Output 1.2.: A National Policy for the Electricity sector is developed, adopted and disseminated and a new legal framework is designed to align with it.

The law of electricity is a relatively new and dynamic field of law. It operates in a legal and regulatory environment in construction, with more dynamism than in legal matters already established. Like many other developing countries, DRC is still in the process of creating laws and energy policies, while developed countries (even emerging countries) are significantly advanced in this respect.

The project will therefore have to align the Congolese energy law with international standards, especially as the DRC is one of the world's energy giants, as the Renewable Energy Atlas has demonstrated. To do this, the project will start by supporting the development of the National Policy of the electricity sector, which will not only reflect the size and importance of the sector for the country, but also give MHP a prominent place in presenting it as a strategic priority axis to enable the country to quickly reduce its energy gap and achieve national SE4ALL objectives;

Then, the issue will be to support the development of new legal and regulatory instruments under the new National Policy, which in the end, will offer an exemption plan for the MHP sector for the next decade, in order to encourage investment in the sector, enabling operators to intervene there without too many barriers, and amortizing their capital in a timely manner.

Activity 1.2.1. Launch the development process of a national policy for the electricity sector.

The development of the National Policy of the electricity sector is a prerequisite for its harmonious development, since it will result in: 1 / the National Electrification Plan and 2 / the National Plan for Electrification of rural and peri urban areas. The road will also be marked for the enactment of new laws and regulations that will facilitate the achievement of this policy, in order to see the realization of national aspirations for the sector.

Developing the Policy goes through the preparatory phase, the diagnostic phase, the phase of drafting, validation phase, and the monitoring and evaluation of the implementation of the policy and action planning.

The project and its partners will seek, from the start of the process, the involvement of the highest National Authority, in this case the Head of State, who will launch the Policy, surrounded by the highest levels of government who will testify by that their commitment to support it. This is essential to emphasize its importance and that of the expected results. This commitment also shows stakeholders the need for their active participation, and avoids the risk they interpret it as a mere symbolic or administrative exercise.

A multidisciplinary team of consultants will be recruited and established to support this process. They will contribute to the drafting of terms of reference of the process. It will be preferable to retain for the consultant profile main disciplines in the document, including energy, operational planning, law, socio-economic aspects, etc. We will have to constantly keep in mind the complexity of reforming the sector and assign clear and realistic goals for the coming years to achieve the SE4ALL objectives.

Besides consulting, a technical steering committee of the process will also be established to ensure compliance of stages, actions and directions taken with the national vision.

There have been studies at the global level that have weighed down on the socio-economic impacts of reform initiatives in the energy sector in the countries of sub-Saharan Africa. These have revealed that only very few of these initiatives have resulted in a significant improvement in the electrical power service to the poor communities in rural areas. It has even been proven in the context of some countries, that these reforms have rather had the opposite effect, worsening energy poverty in target populations.

This is why consulting will be meticulous on this aspect in order to arrive at a policy which will lead the country to Short, Medium and Long-term improvement in indicators of service in rural energy, giving most attention to the development of micro hydropower for which the DRC has a clear comparative advantage over the rest of the sub-region. They will also be asked to take into full account best practices in the sector, as well as recommendations to states at the international level.

The launching of the process will be the outcome of the preparatory phase. It will be conducted by the Head of State or his delegate, because the fact of obtaining early the explicit support of the latter, and with it of other high levels of government, will encourage the rest of the sectors, public, private, civil society, community, religious, and others, to participate actively, especially if we can demonstrate the relevance and importance of the process for their respective fields, or the risks inherent in their abstention.

Workshops will be organized to supervise the redaction of the new policy, in particular to identify strategies, priorities, expectations, etc.

A process to develop a Public Policy is by definition a highly participatory exercise. The relevance of the expected results and the alignment of its stakeholders on its prescriptions will depend on their participation. Thus, provincial workshops led by experts who have mastered the problem will be organized first in the 11 provinces, and then at the national level for the synthesis step.

A preliminary report of this process will be developed. Theoretically, the preliminary report can not be produced within 12 months from the start of the process because it takes about 18 months to get there, taking into account the vastness of the country and the challenges it poses in terms of mobility of people and information from certain parts of the country. The consultants will be part of the secretariat of the workshop, and support the production of the preliminary report to be submitted to the approval committee.

The approval committee will be formed with key stakeholders in the electricity sector, from the public, private, religious, civil society and international development partners. The findings of the committee will result in a consolidated document, which will be the base support in the second round of provincial workshops, dedicated to the formulation of strategies for action.

The formulation of the National Policy will take time to i) mature ideas in their substance and in form, to ii) define national and local priorities, design national strategies, etc. It will be sanctioned by a consolidated document (report on provincial workshops).

Workshops involving the steering committee, the validation committee and key stakeholders will be organized in order to do a check up of the relevance of the priorities, strategies, activities deductions, etc. in the consolidated report of the second wave. These analyzes will be followed by the consolidation of the document and its preparation for the validation step.

Activity 1.2.2. Publication and dissemination of the National Policy

The Project Steering Committee will convene stakeholders' validation workshop at the end of which will follow the official publication of the document by the regulatory authority, and the launch of an outreach program at the national level. The website dedicated to MHP will be utilized for this purpose.

1.2.2.1. This activity will consist in the finalization of the draft national policy document, and the validation of the document taking the form of a workshop with participants from a technical and/or financial background.

1.2.2.2. Once the document is technically validated, it will be submitted to the Government of the DRC for a formal ratification. At this level, the process will require the involvement of key persons at the political sphere, within both the Government and the Parliament.

1.2.2.3. and 1.2.2.4. Following the ratification process, a national forum for the publication of the policy will be organized, as well as provincial dissemination workshops.

Activity 1.2.3. Launch the process of revising the legal framework and alignment of the new texts upon the national policy for the electricity sector, concerning MHP

Following the new national electricity sector policy enactment, it will be time to develop new laws, and further to enforce them for a better alignment with the national vision. The project and its partners will take this opportunity to request a short and medium term exemption from registration, for renewable energy and especially for the MHE initiatives, and harmonize for the long term any fiscal issues and financial incentives⁴¹ to be dealt with between the central government and the provincial governments. This is to better financial viability of both the projects and the government⁴².

In some foreign jurisdictions, the tax incentives can even get up to half or two-thirds of the revenue stream of the project, especially during its first years of inception. In support of the quest for exemption from registration, the National Policy of electricity will deepen issues related to comparative advantages of a scenario called “active” ie when the state exempts the industry for a while, and another one called “passive” in which the state does not intervene. Opportunity cost in this case seems negligible when spread in the long term, because, in fact, what the national economy will be “losing”, will eventually be recovered by the profits engendered by a relatively rapid development and wide national coverage by MHP along with. And with the availability of electricity in rural areas, it can be shown easily that will follow, *mutatis mutandis*:

- An increasing number of small and medium enterprises
- A specialization and diversification of local crafts
- A revival of the local economy, with among others the new leads, such as petty trading lamps and cables, household electrical appliances, repair, light processing of food products, etc.
- The increase of the number of tax payers in the tax base, as consumers of the electrical energy, whose contribution are nil to date, will normally be paying their dues to the state.
- An improved Human Development Index (HDI) A reduction in the rate of unemployment, a significant reduction in a medium end long term of rural-urban migration
- A relative reduction of poverty; downwards pressure on forest resources.

1.2.3.1. Recruit a support consultant in the review of the national electricity legal framework, to incorporate specifically MHP

The process of developing the legal texts is complex and laborious by nature, therefore, the use of a consultant will not only better coordination of efforts, but also speed up the process. , especially as the National Policy has paved the way to an approach that address each type of energy as a special subject.

The Atlas of renewable energies of the DRC in fact, inventories these different types: hydropower (in which the micro hydropower is found), wind, solar photovoltaic, biomass, and agricultural residues, the law of the sector adds the geothermal type, but does not provide for any mention as for the nuclear energy. The state thus need a set of legislation that will not be limited to cross-cutting issues of these different types of energy sources, as is the case of the law in place, but instead address their own specific sides, by taking into account their own specificities, and thus bring some more realism into the law.

⁴¹ These types of incentives and fiscal mechanisms can take the form of tax deductions, tax rebates, sales tax exemptions (on the system), tax credits on production periods and places free of taxes, relief from import duties, subsidies (direct, indirect, production, consumption, export, tax, etc.), regulatory and trade benefits to preferential treatment, etc. (source: RETScreen 4, 2013, Ministry of Natural Resources of Canada, 1997-2013)

⁴² Source: RETScreen 4 software, 2013, Canadian Ministry of Natural Resources, 1997 - 2013)

1.2.3.2. Setting up of Ministerial and Inter Ministerial Committees for the preparation of texts: the consultation referred to in point 1.1.4.1. above will besides support the setting-up of the Ad Hoc Inter Ministerial Committees in charge of drafting the texts in question.

1.2.3.3. A literature review will be conducted on the legal regime in force, acting on its strengths, weaknesses, gaps, etc.: the literature review is necessary for a state of exhaustive inventory of existing texts in the field, followed by an analysis of the strengths and weaknesses of each, and a study of gaps and ways to address them. As stated in paragraph 1.2.3.1. above, one of the gaps to fill is undoubtedly that of the lack of specialization of texts, based on the types of energies considered (wind, hydro, biomass, photovoltaic, etc.) while being put in the same bag by the current law.

1.2.3.4. Support writing workshops by the Ministerial and Inter Ministerial Committees. The financial support will grant project are (reimbursement of transportation costs, office supplies, catering costs, fees internment if necessary, and any other fees according to the rules of use UNDP) such support has the merit to support efforts team delegates in commissions for the production of the work promptly.

Activity 1.2.4. Organization of a campaign of advocacy addressing the law making bodies on the need for passing new laws, and a new legal framework.

The path to the adoption of these new regulations will be that naturally follow all Bills: Ministry of Energy/Central Government/Parliament/Senate/Presidency of the Republic for promulgation, etc. Failing to build the capacity of all elected officials on environmental matters, it should launch an advocacy campaign targeting certain commissions to convince them of the urgency and relevance to renovate and modernize the legal framework of the electricity sector DRC.

1.2.4.1. Proceed to targeting the official bodies provided in the plea: this prerequisite may be done before any other steps in order to organize messages and information to address each type of target, taking into account its role in the legislative or regulatory chain.

1.2.4.2. Develop an advocacy plan: planning is the key to any business that wants a success. Taking into account the timing of the project and its partners, especially the agendas of the target (eg recess, occupations of Ministers, etc.), plans and micro advocacy plans should be developed and shared time with stakeholders in order to ensure broad participation.

1.2.4.3. Organize an advocacy: the activity is planned for the third year of the project, the presumption on which the project is from the newly elected are not very equipped on environmental issues in general and on energy issues in the DRC in particular, where the the need to engage them. This is the justification of these advocacy campaigns that will bring them both the required information, and to take decisions. Exempting the above scenario will be among the key messages.

1.2.4.4. Support the development of new texts: the different types of listed energies: Hydropower, (where we find the micro hydro), wind, solar photovoltaic, biomass, and agricultural residues; geothermal will require special regulations. It is in this guise that MHPP also will be equipped with own texts.

1.2.4.5. Support the adoption and Implementation of new texts: studies worldwide has proven that the issue is not necessarily that of passing new laws and renewing the lalgal framework

accordingly, but that of the implementation, and compliance with by different stakeholders. Therefore, the project, its steering committee and its partners shall pay a particular attention to this.

1.2.4.6. Organization of dissemination workshops of new texts: workshops will be organized according to the importance of the matter and the target to achieve at the local level (in the pilot sites), provincial and national.

Output 1.3. A specific program for capacity building of national supervisory bodies of MHPP is set up and executed annually

A capacity building program designed specifically for local and international agencies will be set up, starting with the Ministry of Water Resources and Energy, the Regulation body and the financing Institution, as well as other international actors in the MHPP sector, for the implementation of regulatory instruments and henceforth reduce financial risks attached to the sector.

Activity 1.3.1. Establishment of an annual program of Capacity Building and exchange of experiences in favor of the parent bodies of the electricity sector, MHPP project developers, and CLED.

The project will give special attention to ground activities. Sharing experiences between all the bodies involved in the electrification process of the country is a helpful strategy. It will, *inter alia*, allow effective communications between them and favor further harmonization of views on various topics. It can furthermore play a role as a breeding ground to common issues subject to capacity building or capacity strengthening. The below sub-activities are planned:

1.3.1.1. Launching of a consultancy to design the program: a consultancy will be helpful for the designing and, later the launching of the program, in the extent that it will address various technical key issues. Only a programme properly designed, and consequently implemented will guarantee a successful program.

1.3.1.2. Launching of the program: the launching of the program will be done with the assistance of all the stakeholders, nation wide, especially those with a well advanced pace in the field.

1.3.1.3. Organization of national and provincial workshops to exchange experience and capacity building on various topics associated with MHPP: individuals, organizations, communities, etc. nationwide, who are well advanced in the field will be asked to play a major role as to sharing their experience with new developers whose number are expected to increase on the course of the activities of the project and its partners.

Activity 1.3.2. Support the development of the National Electrification Plan in Rural and Suburban areas

The law announces the development of a National Electrification Plan in Rural and Peri Urban, to be inserted in the National Electrification Plan (Art. 96 of the Act of 17 June 2014) under the aegis of public institution in charge of the promotion of electrification in rural and suburban areas. Indeed, the achievement of national targets SE4ALL pass mutatis mutandis with good and consistent planning, followed by a consistent implementation. Therefore, the project will support the development of the National Electrification Plan in Rural and Suburban.

The development of such an instrument, in addition to the National Policy paper for the electricity sector is a prerequisite for its harmonious development. Obstacles to the fulfilment of the vision assigned in the Policy instrument will quite easily be displayed on the course of the planning process exercise, which will be carried out by various and multidisciplinary stakeholders engaged in the electricity field.

Similarly to Developing the Policy of the sector, the national planning goes in general through standard steps (phases): a preparatory, a diagnostic, a drafting, a validation, and the monitoring and evaluation of the implementation of the policy and action planning.

1.3.2.1. The support of the process will involve technical assistance: a multidisciplinary team of consultants, planning backgrounded may be recruited and put to task to support the process. They may too contribute to the drafting of its Terms of References.

Besides consulting, a technical steering committee of the process will also be established to ensure compliance of stages, actions and directions taken with the national Policy.

1.3.2.2. Organize a national launching workshop: the project and its partners will seek, from the start of the process, the involvement of the higher National and provincial Authority, in this case the Head of State,

1.3.2.3. Organize provincial planning / drafting workshops: workshops will be organized involving various parties, and supervised with the help of the National Ministry of Plan, joining his colleagues focusing on water, energy and environment.

Output 1.4. A scheme based on the principle of Output Based Aid (OBA) is designed, launched in pilot phase and is then adopted as financial assistance strategy to MHPP developers for financing and promoting rural electrification

The combination of two parameters: 1) market pricing and 2) the establishment of an OBA scheme is the best way to find a solution to the underlying difficulties such as considerable financial risks faced by MHP projects in rural areas in the DRC.

It is therefore essential to have a pricing structure taking into account the cost recovery to ensure the commercial viability of MHPP providers, but it is generally unrealistic to expect to have a pricing ensuring full recovery of costs incurred, given the limited purchasing power of the rural areas. Thus, the ability of MHPP operators to mobilize financial flows needed to recoup their investments and cover OBA fees depend on two factors:

- a) The customer's purchasing power, and
- b) The existence of consumers who will be able to pay high prices, such as commercial companies that accept and may pay more than the average. In all countries of the world, almost all rural electrification programs, both in developing countries than in developed countries, involves some form of public subsidy.

The OBA approach is considered as a source of additional incentive funding for service providers in situations where it is impossible to apply a financially viable pricing. OBA schemes have demonstrated their ability to stimulate the market, to influence the interest and private investment to ensure adequate model for mini networks based on the use of hydroelectric power on a small scale around the world.

The OBA will follow UNDP Micro grants policies and procedures, and in term of procurement as well. It would be like procuring upfront a certain quantity of electricity in bulk (xx kWh @ a certain subsidized price of yy \$ per kWh, to be paid upon delivery). The mini-grid operators will be selected competitively and that the required subsidy will be a selection criteria; it would be like a reverse auction with price recovery: companies are invited to bid for the installation and operation of the mini grids and they would need to indicate how much subsidy would be required to achieve viability. A thorough study on how it will operate is expected at early stages of project implementation.

Activity 1.4.1. Definition and launch of a pilot phase of OBA scheme

Based on a detailed analysis of the obstacles and in consultation with the project leaders, MHPP will define and implement a strategy to reduce OBA risks associated with operations, deliveries and investment market pilot projects that will undertaken in Component 3. The scheme will offer higher prices (for example, differential rates between market rates and prices for financially viable MHP projects with a contribution of GEF funds up to 60% of the difference prices during the first years of operation of the plants. Predefined eligibility criteria can be used as standards for access to OBA grants:

- The number of low-income households connected to the mini network
- The minimum recovery rate
- The existence of a genuine OBA scheme
- The number of connections for low-income households or social facilities
- Power generation: kWh of electricity produced MHC
- Etc.

The definition of this pilot phase will collect and document vital information and draw the necessary lessons regarding eg the level of assistance required, the form that we should give it and the specific provisions from such experience on different sites with different operators and consumers.

The grant will be gradually decreased and subsidies will be limited to the initial stage: the first three years of operation of a MHP project is the period necessary in setting a sustainable scheme and develop their database customers, but is also the period necessary for clients to trust a new supplier.

The scheme will cover only part of the MHPP costs (with, for example, sharing of connection costs and fare difference socially acceptable and financially viable). Therefore, it does not reduce the need for an effective recovery system. To avoid such a deterrent location, one of the eligibility criteria towards MHPP developers will be the establishment of a minimum recovery rate (only operators who are able to demonstrate a higher recovery rate than or equal to 80% will be eligible to receive grants).

Activity 1.4.2. Incorporation of OBA pattern in the standards for financing of a MHP assistance strategy

To ensure the sustainability of the scheme beyond the project, working closely with the Public Establishment in charge of electrification in rural and suburban areas is required. The project will support the establishment and operationalization of it. It will integrate strategy as the OBA financial assistance scheme for mini MHP networks. In parallel with the implementation of the pilot phase, a proposal will be prepared for the government which will include a program of

financial assistance to the extent provided by the Public Establishment in charge of electrification in rural and suburban areas.

Activity 1.4.3. Launch of the generalization of the OBA strategy phase

This phase will be the logical continuation of the first two. At this point, the pilot phase is over, and the project has sufficient information and its partners on the contours of an OBA strategy adapted to different contexts at the national level and replicable on a larger scale.

Component 2. Reinforcement of the technical capacities in the technological supply chain

This component will address technical barriers to the implementation of MHPP-based small and remote grids. The outcome can be summarized as follow: technical capacities in the technological supply chain to provide turnkey solutions and services for the management, operation and maintenance of quality for MHPP at national and provincial levels are developed in a sustainable manner.

It seeks to overcome the access to reliable and cost-effective technologies in DRC to showcase proven commercially viable mini- and micro-hydropower technology, in remote and off-grid areas and provinces.

This will help to strengthen the technical, resource management, financial capitals and business acumen of the poor in rural areas. It will ensure that the key players in the field of small scale hydropower, such as MHPP developers, power producers and end users along the value chain is strengthened to work together so that a local knowledge and a expertise at provincial level emerges in DRC.

Trainings, cooperation and knowledge sharing will be promoted to strengthen the social capitals through peer-to-peer learning and help mobilize local resources with the technical, engineering and professional institutes present in the provinces of DRC. The ultimate aim is to develop local social entrepreneur and local engineers and experts specialized in the design, the development, the operation and the maintenance of mini- and micro-hydropower systems, including the management of mini and remote grids.

Output 2.1. Technological problems are identified, assessed and addressed

Activity 2.1.1. Even though the potential for hydropower is huge in DRC, the technological supply chain is still weak, especially in the provinces (with the exception of Katanga and Kinshasa provinces). There are a few small operators identified in some provinces (Kasai Occidental, North Kivu, South Kivu, etc.) that are able to do the engineering, procurement and construction (EPC) for basic hydropower plants using imported machinery and turbines. But in most of the cases, operators do not have the proper technical and engineering skills required to manufacture, install, operate and maintain a system optimally. Mechanical engineering departments in provinces either do not exist or are not equipped with modern machinery tools. This activity will enable to identify the gaps in the MHPP-related expertise.

Activity 2.1.2. Technical and financial management is also missing. In rural areas, the technical expertise available is not prepared for the financial management of power systems, or for daily Operations and Maintenance (O&M) of MHPP. The low number of skilled workers in the energy

sector is an additional risk and increases the operating costs of MHPP, because of the need to bring foreign expertise for repairs and even basic maintenance. This activity will contribute to organize some technology transfer on MHPP.

Activity 2.1.3. The level of training of operators is still very low. Some local NGOs are supported by international NGOs to train small operators on an ad hoc basis operators. This activity will provide a financial support to these NGOs to carry out some existing MHPP projects requiring O&M capacity building.

Activity 2.1.4. Professional training institutions such as INPP, engineering schools like ISTA, IBTP, the Polytechnic Faculties, etc., with electricity and engineering related degrees and subsidiaries throughout the country, do not have any specific module or training programs on small scale hydropower systems. This activity will support these institutes for the development of such modules, training programs and eventually degrees.

Output 2.2. Technical assistance to local operators is provided

International technology transfer (experienced MHPP manufacturer) will be sub-contracted to deliver such assistance. In addition, the project will provide O&M&M training courses to the entities located in pilot sites who will take on responsibility for MHP operation and maintenance, either existing mini-grid operators or newly established companies or community-based organization, depending on adopted business and ownership model for pilot projects.

The purpose is to create lasting capacities on the ground to ensure adequate O&M&M services. Also, community organizations in pilot locations (local NGOs and SMEs/productive users) will be provided with assistance and advice on the relevant aspects of MHP operations, such as identification of potential sites, pre-feasibility assessment, business planning. To institutionalize MHP training program, partnership will be established with national educational institutions, involved in provision of technical and vocational training for engineers, manufacturers and other technical specialists. The project will support development of training curricula and educational materials, whereas partners will be required to include the proposed program in the list of regularly taught courses. The selection of educational partners will be conducted at PPG stage.

Activity 2.2.1. The project aims at strengthening the capacities of the operators. It is particularly important to make sure the technical knowledge and the skills to run performing small scale hydropower systems are available even in remote regions and provinces. This concerns also the maintenance of the current hydraulic and electromechanical equipments, including the control systems, the management activities related to power production (maneuver of the command and control systems, monitoring, management of maintenance, optimum utilization, etc.). Training will be proposed to these operators. A small contribution will be requested to attend the training.

Activity 2.2.2. In addition, the project will provide a training on Operations, Maintenance and Monitoring (OMM) to appropriate entities located in the pilot sites proposed in component 3. This training will target existing mini-grid operators, newly established companies or communities, depending on the business model. The objective of this training is to reinforce skills in pilot sites to ensure that adequate OMM services will be delivered.

Activity 2.2.3. Community organizations in the pilot sites (local NGOs, SMEs, “productive” users) will also receive assistance and guidance on MHPP-related operation techniques, such as for the identification of potential sites, assessment or feasibility studies and business planning.

Activity 2.2.4. To institutionalize MHPP-related training programs, a partnership will be established with various national educational institutions having a high reputation and a recognized experience in training students on hydropower systems in their educational programs, existing technical and professional engineering trainings. The project also includes the development of a training program and training materials that partners should include in their educational modules proposed to their students. The selection of these educational partners will be based on a list of specifications detailed in a call for applications.

Activity 2.2.5. The implementation of any training program will be conditioned by the recruitment of an international consultant who will train the trainers as part of this project.

Activity 2.2.6. A training manual will be prepared as part of the project. This manual will focus on MHPP, covering all aspects of the development of a plant, from the identification of a potential site, to the design phase and OMM tasks. This manual will be published as part of the project. It will include the following chapters.

- All administrative and mandatory prerequisites in obtaining the license for the exploitation and development of a MHPP will be listed.
- Indication about technical studies to be undertaken will be included. This will be the bulk of the studies support to the decision process upon delivery of the operating license. These studies will focus on the feasibility, the site selection, the measures to collect hydrological data, the selection of electromechanical equipment, project profitability, etc⁴³.

Output 2.3. The technical capacities of local manufacturers, service providers and operators are strengthened

The MERH has identified several domestic manufacturers, which will benefit from project's assistance. The aim is to help these manufacturers, as well as service providers, to upgrade their capacity for delivering turnkey solutions for MHPP developers and operators with up to 50% of the value provided by locally made goods and services.

⁴³ The manual will include the following phases for the development of MHPP:

- Development phase: This phase will include a study of detailed design and the preparation of specifications and general technical requirements for the project implementation phase. The timing of this phase will depend on the available data. The work will mainly focus on how to achieve the optimization of a project on the basis of discounted electricity needs in the communities to be electrified, technical data, the evaluation of prospects for economic development of these communities and their surroundings, demographic prospects, annual consumption, etc.
- For each project, the following items will be described in the manual:
 - o review existing documents and studies on hydrology, topography and geology;
 - o optimize the equipment scheme based on topographic, hydrological and the electricity market;
 - o determine the installed capacity (considering seasonal fluctuations, the possibility of accumulation of water, the drop height);
 - o design the civil works (dam, water intake, headrace, penstock, power plants, weirs ...), key equipment (turbines, generators and transformers) and power lines (line type, the optimum voltage, the description of the traces, the nature of the poles and / or towers, the protection of the line);
 - o specify the technical requirements specifications by project justifying the choice of the overall solution, the general and specific characteristics of the equipment. The manual will provide the equipment plans and facilities as well as diagrams for the connections of control systems and control;
 - o study the dimension related to the economic viability of the project;
 - o identify environmental impacts.
- Implementation phase: It will cover the control and the supply of materials at different sites and building materials, production equipment (turbines - alternators, regulators, transformers and controls) and other related equipment. Also, explanation will be given on the construction of the structures, the installation of equipment and the construction of an electrical network.
- Operational Phase: The manual will describe various control systems, maintenance systems aimed at the sustainability of all structures and equipment.

Activity 2.3.1. The project will also focus on each pilot site, with the establishment of management committees for the local production, transportation and distribution of the power coming from the MHPP in the pilot sites. It will also provide needs assessment and contribute to a plan for capacity building management committees in technical and organizational areas and for operators. These initial trainings will be organized each year and will include booklets available to project developers, operators and members of management committees.

Activity 2.3.2. Different advanced training programs on capacity building for MHPP-related manufacturers and operators of MHPP will focus on the following aspects:

- Design hydroelectric plants;
- Operation of hydropower plants;
- Operation and Maintenance of a MHPP;
- Elements of financial management;
- Sensitization, mobilization and community participation;
- Collection, analysis and management of hydrological data, etc.

Activity 2.3.3. Technical training to local manufacturers (for the supply chain of the entire electricity market) are needed. The project will enable to organize such trainings with local academic and technical institutions targeting local manufacturers

Output 2.4. Technical advisory services and management support for MHPP developers and end users are set-up

Activity 2.4.1. In the decentralized entities at the provincial level, the project will develop technical advisory services which can be consulted by potential local investors, operators, etc. This will allow the appropriation of the technology and thus facilitate the development of MHPP in DRC.

Activity 2.4.2. User management and commissioning of technical advice should be carefully studied to avoid infringing the prerogatives of the National Management Authority of rural electrification under the new Electricity Act. Trainings on the matter will also be given.

Activity 2.4.3. Long-term capacity building program for the promotion of MHPP will also be implemented to ensure sustainability. The project offers two types of training programs in the field of MHPP: a first level program of vocational training (targeted towards workers) for the O&M activities, and a second program targeting university-level staff to ensure the sustainability at the project level.

Component 3. Pilot investments in selected mini- and micro-hydropower stations in rural areas

This component will serve as a showcase of the business model which allows access to finance to the small scale energy suppliers by MHPP, with a few identified sites suitable for MHPP to be either developed or rehabilitated. It will lead to the provision of stable and affordable electricity in rural areas, and increased rural commercial activities from access to electricity with the establishment of enterprises using electricity. Besides, in the pilot sites, indoor pollution caused by indigenous energy sources will be reduced.

The outcome will be an increase by 10 MW of the installed capacities in MHPP in rural areas. Through the project, several MHPP are developed, implemented and operationalized based on local and/or national know-how to enable rural electrification and the supply of energy services, for a total installed capacity of 10 MW by 2017.

This component of the project aims to pilot the sustainable business model, and to develop the identified pilot sites and secure the institutional investment framework. For the pilot investments, an important activity is related to the exploitation of the demonstration MHPP using a sustainable maintenance management model.

Output 3.1. Pilot sites are identified and validated for development

Activity 3.1.1. This activity will confirm the identification of energy suppliers and implementation sites. Regarding the identification of energy suppliers, there will have to be set on a case-by-case approach. Regarding the sites selection, the Atlas of Renewable Energy gives some details concerning renewable energy sites in which potential hydropower sites are identified, which are calibrated for this project, i.e. between 50 and 2000 kW. The selection covers potential sites totalizing circa 1 MW by province. The selection criteria that are used in the technical, environmental, economic and financial studies will comply with the following criteria:

- Accessibility: the selected sites should be accessible by road, plane, boat or train ;
- Proximity of a mini-grid: the selected sites should be nearby an existing small grid (+ or - 10 km) to avoid high connection costs ;
- Existence of a small electricity market: the presence of socio-economic activities synonym of increasing electricity demand is a prerequisite in the selection of the pilot sites. For the same reason, there should be concentrated rural households (i.e. a village) which are or will benefit from the additional electricity supplied ;
- Profitability: the selected sites should demonstrated economic and financial viability ;
- Mitigation of security risks: the projects should be developed in secure rural areas.

The table below gives the localization and characteristics of the pre-identified sites:

*Table 6: Localization and characteristics of the pre-identified sites
(a detailed table is provided in annex 3)*

Province	Sites	District or Territory	River	Installed capacity (kW)	Place to be electrified	Costs (CAPEX) ('000 USD) ⁴⁴
Kinshasa	Mbankana	Maluku	Lufimi	100-300	ONG CADIM et la ville de Mbankana	250-750
Bandundu	Mwanzi	Bagata	Mwanzi	196	Fatundu Wamba	588
	Mukulu	Gungu	Makulu	315	Mundundu	945
	Munganzaa	Kutu	Munganzaa	200	Mongobele Bondjon	600
	Loano	Bulungu	Loano	236	Kipuka	708
Bas Congo	Nsangi	Madimba	Mfidi	376	Ngidinga	1128
	Nianza	Cataractes	Yangi	200	Luozi	600
	Lunionzo	Songololo	Lunionzo	100	Nsona-Mpangu	300
	Kikozo	Tshela	Lubuzi	194	Kizu	582

⁴⁴ Calculations by the authors. These were done in 2013 and 2014, taking the form of diagnostic and feasibility studies. The ratio of 3,000 USD per installed kW applies when such studies do not exist.

	Kintadi	Kasangulu	N'djili	265	Kimpundi	795
Equateur	Wuwu	Bosobolo	Wuwu	400	Bili	1200
	Molua	Bumba	Molua	200	Bandela	600
	Mole	Businga	Mole	350	Mondjo	1050
Province Orientale	Tsé	Djugu	Tsé	420	Batsi	1260
	Lyenge	Opala	Lyenge	122	Yatoko	366
	Bale	Buta	Bale 2	400	Bondongbale	1200
	Yame	Banalia	Yame	132	Bagbugbuzi	396
Nord-Kivu	Chochota	Béni	Mamundioma	500	Oicha Mbau	435
	Kivirikuku	Lubero	Kivirikuku	500	Kitsumbiro	1500
	Nkanga	Rutshuru	Rutshuru	112	Jomba	336
Sud-Kivu	Sangano	Kalehe	Sangano	40	Kalehe	120
	Mushuva	Kabare	Mushuva	50	Bushumba	150
	Cizimololo	Kabare	Cizimololo	50	Mudaka	150
	Luiro/Formulac	Kabare	Luiro/Formulac	175	Katana	525
	Lubumba	Uvira	Lubumba	500	Ndolera	1500
Maniema	Munumi	Kabambare	Bulungula	153	Kayembe (Wamaza Centre)	459
	Agogo	Kabambare	Lwika	421	Pena Katompa	1263
	Kailo	Pangi	Tshala	237	Lokando Cité	711
Katanga	Lukombe	Kalemie	Kijija	174	Lukombe	609
	Ilunga	Kongolo	Kihombo	160	Ilunga	560
	Musokatanda	Mutshatsha	Tshibundji	165	Musokatanda	577,5
	Lububu	Kabongo	Lububu	147	Lububu	514
	Lukushi	Manono	Lukushi	118	Lukushi	413
Kasai Occidental	Mutefu	Kazumba	Miao	500	Mutefu/Bilomba	1500
	Kaluebo	Luebo	Kaluebo	268	Kaluebo	804
	Kajangayi	Dibaya	Moyo	319	Kajangayi	957
Kasai Oriental	Lukelenge	Commune de Muya (Mbuji Mayi)	Lukelenge	400	Commune de Muya à Mbuji-Mayi	1200
	Ludimbi	District de Kabinda, Territoire de Kabinda	Ludimbi	242	Kabinda	726
	Lomami	District du Sankuru, Territoire de Katak-Kombe	Kalelu	392	Katako Kombe	1176

For a total potential installed capacity of 10.029 MW, the investment required is 29,253,500 USD, without including costs related to the connection to a grid.

Based on the above, this activity will enable to:

- elaborate a short list of pilot sites from the Atlas of Renewable Energy sites;
- select the most promising areas of criterion defined above;
- update existing projects sheets with information about:
 - o the data of the city to electrify (geographical coordinates, activities in the service sector as well as socio-economic activities, population, number of households, number of potential socio-economic activities)
 - o on site data (name and characteristics of the river flow)
 - o energy data (estimation of electricity demand from small and medium-sized enterprises)

Activity 3.1.2. The project will be executed in three phases which are: the development phase; the implementation phase and the operation and maintenance phase. A timeframe will be prepared under this activity, with the formal validation of the selected sites.

Output 3.2. The selected sites are developed

Activity 3.2.1. This phase consists in the execution of the pilot sites, with the full engineering, procurement and construction (EPC) process. It will include the feasibility studies, the technical studies, the detailed design of the MHPP, and the development of procurement plans for the equipment or materials or civil engineering to be installed or for the construction work. Sub-activities to be undertaken are:

- visit the selected sites to mobilize the local communities during the development phase and to start awareness campaigns ;
- prepare and execute the feasibility and detailed design studies of the select sites ;
- realize the environmental and social impact assessments on all the sites selected.

The deliverables that this phase will produce are listed in the table below.

Table 7: Expected deliverables of the development phase

Results (Output)	Description of the result
Feasibility studies	<p>The feasibility studies will contain accurate data and information on elements and parameters essential to successful project implementation. Such data/information include:</p> <p>Topography: A topographical map that gives all the detailed information in the MHPP project area, and allows calculation of the gross head necessary for production of electricity, and hence determines the exact installed capacity of the facility. It also helps to locate the facility such as intake weirs, forebay tanks and powerhouses, and to map the routes for access roads, canals and distribution network.</p> <p>Hydrology: Determination of catchment characteristics such as area, rainfall, collection and analysis of river flows, using existing (or to be installed) hydro-met stations/equipment, establishment of flow duration curves, determination of water quality, etc. This will help to determine the design flow for its use during the operation phase, and to gauge the reliability of the river water for the purpose of selecting the production equipment such as the turbines.</p> <p>Geological and geotechnical studies: A geological survey of the MHPP project site will determine the necessary precautionary measures during construction. It will include investigations on construction materials and along the route for the headrace canal.</p> <p>Economic and financial studies/business plan: These are useful for clarifying the profitability of the pilot investment projects and to establish the cost of energy, project profitability, etc.</p>
Design Plans	<p>A detailed design plan will be prepared for each of the 5 pilot sites. While there might be provincial area specific amendments to a specific plan, the basic parameters include:</p> <ul style="list-style-type: none"> - MHPP layout covering all elements; - plans for each of the works describing views in plane and elevation, longitudinal profiles and cross-sections on a sufficient scale, with the correct structure sizes; - major equipment specifications; - electrical diagrams including connections, control systems, monitoring and protection equipment; - provision of auxiliary equipment; - graphs showing turbine operating conditions and limits; - turbine specifications, including type, number, drop height, number of turns, performance, etc.;

	<ul style="list-style-type: none"> - transformer specifications when necessary, as well as details on electrical data, mode of distribution, and control mechanisms; - details of other equipment such as switchgear, circuit breakers, measuring devices and protection, telecommunications systems, and power systems; - details on foundations, grounding, lightning protection, technical requirements for distribution system, and equipment protection.
Environmental & social impact assessments	An Environmental and Social Impact Assessment describes the baseline situation as well as the expected positive and negative impacts of the MHPP projects. The output includes an Environmental and Social Management Plan which outlines the measures to be integrated into the implementation, operation and maintenance phases to ameliorate the positive impacts and mitigate the negative impacts. It also has an inbuilt monitoring framework to track the changes brought about by the MHPP project and for preventive maintenance of the project elements.
Financial/business plan	The business plan includes annual income and expenses projections (with both CAPEX and OPEX). It evaluates the project's financial state by using known variables such as production capacity, number of households and the unit cost of electricity to predict future cash flows and asset values. This should include grants, loans, governmental allocation and/or community contribution.
Procurement plan	The procurement plan refers to the tendering process for project works, goods and services. It includes details of the works, goods and services to be provided, location details and timelines, deadlines to be observed, as well as full Terms of Reference (ToR) for the provision of the works, goods or services.
Project organization plan	This plan brings the results of all previous outputs together (such as technical design, economic analysis, environmental and/or social impact assessment and procurement plan) and explicitly shows how these have been incorporated into the plan to make it the most viable, feasible, sustainable and accepted alternative for all stakeholders. It includes full and detailed implementation plan for the implementation phase and the operations and maintenance phase with time frame, labour, material inputs and cost estimates. It also includes a complete and accurate Gantt chart covering the whole project period. It comes with the investment plan, financing plan, procurement plan and a training plan.
Preliminary Operations & Management Plan	The O&M plan details the activities during the operation and maintenance phase, providing for details such as timelines, responsible parties and cost of the activities. This plan will be updated once MHP systems are commissioned.

Table 8: Planning for the development phase

Results (Output)	Party responsible	Planned time	Means of Verification
Procurement of consultancy services for the feasibility study	PMU, MERH, MEDD, UNDP	3 weeks	Clear TORs Tenders
Feasibility Study	PMU & Consultant	12 months	Feasibility study report with baseline information, catchment models, flow data analysis, topographical maps, geological & geotechnical reports, alternative sites
Design Plan	PMU & Consultant	6 months	Schematic layout of the project facilities and distribution network Cost estimates <ul style="list-style-type: none"> • Design details for project components • Specifications of the power generation equipment
Environmental & Social Impact Assessment	Consultant, PMU	6 months	Environmental Management Plan
Financial Plan	PMU	2 months	<ul style="list-style-type: none"> • Annual income and expense projections • Cash flows and asset values for the project

Procurement plan	PMU, MERH, MCNT, UNDP	3 months	<ul style="list-style-type: none"> • Details of the works, goods and services to be procured • Clear TORs for the provision of the works, goods or services
Project Organization Plan	PMU	2 months	<ul style="list-style-type: none"> • Detailed implementation plan with time frame, labour, material inputs and cost estimates • Complete and accurate <i>Gantt</i> chart for the whole project period Also includes investment plan, financing plan, procurement plan and a training plan
Preliminary Operations & Management plan	Consultant & PMU	2 months	Detailed activity plan for O&MM phase with responsibilities, timelines and budgets
Contingencies	PMU	3 weeks	(Part of) financial plan

Table 9: Activities of the development phase

Phase	Activities	Details
1. Development	1.1 Start-up	Formation of Programme Steering Team (MERH, MEDD, MF)
		Project Management Unit initialized
		Acquisition of office space & equipment
	1.2 Pre-feasibility study	Site visits & community awareness/consultation meetings
		Data collection (hydrology, topography, geology, demography, infrastructure, economic activities)
		Identification of project sites
		Preliminary cost estimates
	1.3 Feasibility study	Procurement of services for the study
		Catchment modelling
		Hydrology (Flow data collection & analysis)
		Topography & calculation of gross head
		Geological & Geotechnical investigations
		Design/layout (technical drawings, maps)
	1.4 Financial plan	Economic feasibility of the project
	1.5 Procurement plan	Procedures for procurement processes
	1.6 Project organization plan	Project management structure
	1.7 Environmental & Social Impact Assessment	Socio-economic studies (demography, economy, basic services, infrastructure, willingness and ability to pay for services, etc.)
Environmental studies (vegetation, land use, archaeology/ cultural sites, noise levels, water quantity and quality, noise levels, traffic, etc.)		

Output 3.3. The selected sites are implemented and constructed, leading to additional 10 MW of MHP-based power generation capacity

Under this output, the private sector will be encouraged to implement and construct MHPP in the selected sites. The framework resulting from the previous components, especially component 1, will allow the private sector to do that. This phase concern both public and private sectors.

Activity 3.3.1. This phase will consist in the procurement of equipments (turbines, alternators, regulators, transformers and control systems) and building materials, and other related equipment, and the construction of the power house and hydraulics systems, the installation of the equipments and the construction of electrical networks at the different sites.

This activity will be implemented through different steps. It will require to:

- monitor the progress and work of all involved experts (staff and procured) ;
- ensure timely completion of all milestones ;
- link with the training programmes planned in the second component ;
- ensure that necessary national approvals are obtained on time ;
- provide oversight to procurement and contract management ;
- ensure that all environmental standards and regulations according the DRC’s regulations are followed ;
- certify the completed subprojects testing and the commissioning ;
- verify invoices and make payments ;
- in relation with component 2, deliver coaching and planning for community-based organisations and SME to guarantee the use of electricity for income-generating activities ;
- consult local councils and community-based organisations during the completion of each subproject ;
- oversee institutionnal strenghtening and capacity building programmes in relation to the component 2.

Additionally, The Project Management Unit (PMU) will prepare quarterly progress reports. The quarterly report will include descriptions and formative evaluations of the project activities implemented during the reporting period and planned activities for the next quarter. The PMU will be responsible for compiling semi-annual reports to be submitted to the Steering Committee.

A project completion report will be prepared by the PMU and submitted to the Steering Committee within 3 months of the completion of the Development Phase. To share lessons learned and build an environment for replication in the DRC, the PMU will also prepare a project replication assessment report. Fostering transparency, the semi-annual reports will be posted on the project website.

The MERH has not been the recipient of significant capacity-building development assistance over the past years. As evidenced by the completion of this application, housed within MERH are a large number of experts. The PMU will support MERH in its implementation efforts. To further develop its implementation capacity, the project will emphasize the need to build capacity in project management and technical skills in hydropower development. Procured experts will provide on-the-job training and capacity building of MERH’s technical staff in relevant areas such as design, implementation and use of MHP, while capacity building for community-level technicians will be done by MERH and procured experts.

Since the Project will directly benefit communities, their involvement in decision making, project management, and addressing social safeguards will be built into the Project. In order to facilitate the community approach, the Project will consult with community-based organizations in the subproject areas and provide them with capacity-building support. The community-based organizations will be responsible for assisting project staff in the day-to-day operation of the MHPs, and also may be given responsibility for metering, billing, and tariff collection. The

community- based organizations will be the focal point for the Project's efforts to establish small enterprises and other income-generating activities.

Technology

MHP is a mature and proven technology that is readily available. The advantages of MHP over alternative sources are mainly the reliability and flexibility of operation, allowing for instant starts and stops in response to rapid fluctuations in demand. It adapts to the availability of water and local energy amount needs. MHP systems have a long life with little need for civil engineering. For this project, we are projecting 30 years but its quite possible in 50 years these MHPs will still be working, and working well. With MHP the technological and pro-poor advantages are comparatively linked when compared to other energy systems:

- Some components of MHP can be locally manufactured and the MHP systems can be installed use mostly local labour
- MHP are comparatively easy to manufacture and install indigenously, thus boosting employment among the poorest, economic activity and the industrial base
- MHP systems can be locally managed, operated and maintained with training input to the local people
- The operational and management costs are lower than for the other energy systems
- The adverse environmental effects are minimal

MHP systems for this project will be preferably run-of-river; in other words there is little or no water is stored. Without dam construction, these run-of-river installations do not have the same kinds of adverse effect on the local environment as large-scale hydro. Hydraulic power is captured wherever a flow of water falls from a higher level to a lower level. The vertical fall of the water, known as the "head", is essential for hydropower generation; fast-flowing water on its own does not contain sufficient energy for useful power production except on a very large scale. Hence two quantities are required: a Flow Rate and Head. Years of MHP use have shown that it's better to have more head than more flow, since this keeps the equipment smaller. For this reason, MHP site designation and design will focus on head.

The main components of the MHP system are as follows:

- Water is taken from the river by diverting it through an intake at a weir. The intake weir keeps the water in the stream high enough to fill the pipe at all times.
- Water is carried horizontally to the forebay tank by a small canal or 'lead'.
- Before descending to the turbine, the water passes through the forebay in which the water is slowed down sufficiently for suspended particles, trash to settle out.
- A pressure pipe, or 'penstock', conveys the water from the forebay to the turbine, which is enclosed in the powerhouse together with the generator and control equipment.
- After leaving the turbine, the water discharges down a 'tailrace' canal back into the river.

An electricity distribution network is envisaged to cover a total 146,027 households or electricity connections, around 10 public buildings and 20 small and medium industries per site.

Depending on the proximity of the community to be served, the power distribution will either be done directly to households, or through a power distribution network or grid. For the larger three plants, it is likely that a more elaborate distribution system, with a grid, will be used. In this case, the electricity generated (usually 11-25kV) will be passed through a step-up transformer that

raises the voltage (to 400kV, 220kV or 132kV as necessary) so it can travel long distances through the power lines (normally 33kV or sometimes 66kV).

At the service area level, a local substation will be installed, with step-down transformers reducing the voltage (back to 11kV) so electricity can be shared and directed to the users. Meters will be installed to measure usage. At this point, a transformer further reduces the voltage from 11kV to 415V to provide the last-mile connection through 415V feeders to individual households, institutions. Most users, especially households, will be connected to single phase supply (240V), while the larger enterprises may require three-phase supply (415V).

Table 10: Results & type of investment

	Results	Type of Investment	Description of the result
1	Access to 39 hydro power sites	Service	Payment and Receipt of Land
2	Site Construction Approval	Service	Payment and Receipt of 39 Construction Permits
3	39 Accessible Sites	Works	Life span (1 year) Construction of 39 Access Roads
4	Procurement of Power Generation Equipment	Goods	30 year life span for the Generators 39 Generators, Transformers, Control Panels, 39 Turbines Counters
5	Construction of facilities	Good	Transport Hiring of trucks (4 years)
		Service	Labour Hiring of skilled/unskilled labour (4 yaers)
		Goods	Construction Materials (cement, sand, iron bars, screens, wood, windows, doors)
		Work	Intake/weir Head race canal Forebay Penstock Powerhouse Tail race canal Distribution network
6	Installation of Equipment	Work	Turbine Generators Control panel Transformers
7	39 Committees take over the Governance of the Mini-hydro schemes	Service	Employment of Project Staff
		Service	Training and establishment of the Community Management Committee

8	Continuous provision of Electricity	Service	43,800 MWh electricity produced every year
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The following areas were identified as skills gaps for the rural community and stakeholders:

- a. Understanding how different MHP systems work and function (wider understanding of mini-hydro schemes)
- b. Design of MHP systems
- c. Project management and financial management skills
- d. Community sensitization, mobilization and participation in MHP systems
- e. Operations and maintenance skills at provincial and local levels
- f. Calculation of CO₂ emissions/savings of MHP systems
- g. Collection, Analysis and Management of hydrological data

Training is the key to project sustainability especially in this project that entails introducing new technology to underdeveloped and remote rural areas. MHP development training to various related groups including community councils and local groups includes:

- Communities and their leaders informed about the benefits and limitations of MHP installations, plus their responsibilities and actions in MHP use and maintenance.
- Basic information provided to consumers regarding the end use of electricity.
- Owners/managers trained in various aspects of plant operation, including load management: following operation procedures; watching out for malfunction signs; book keeping; and scheduling of maintenance and repairs etc.
- Operators trained in operation and maintenance procedures
- Mechanics/technicians (e.g. from nearby workshops) trained in various aspects of MHP system components, its functioning, assembly and so on, so that they can undertake repairs easily.

Training will cover the above areas. Training will be done via procured expertise being used to install MHP systems, on-the-job coaching and mentoring in project management and financial management.

Output 3.4. O&M of the selected sites is elaborated

Activity 3.4.1. Preparing the O&M phase is the harvesting part of the project, where the service reaches the beneficiaries to change their lives and bring impact. At the commencement of this phase, a competent team of project staff will be recruited, and will be hired based on their expertise and experience in operating and maintaining similar facilities.

The key subactivities under this phase include the following:

- Operation of power generation plant for production and distribution of electricity
- Inspection and regular maintenance of facilities and equipment, including patrolling and maintaining the distribution network; cleaning and general maintenance of intake, weir, canals, forebay tank; lubrication of the power plant equipment; maintenance of meters and other distribution equipment; ensuring all equipment are regularly serviced and in good working order.
- Hydraulic and other monitoring studies, including collection and analysis of flow data, as well as other monitoring data

- Follow-up and enforcement of measures recommended in the Environmental Management Plan (visits to sites to monitor implementation of activities)

Project management will include training on O&MM and involvement of community-based organisations; training materials created in local languages and visuals (low literacy rates); creation of common faults and fixes training materials (local languages and visuals); and delivery of on-site maintenance kit.

Overall, it will be the direct responsibility of the project staff to ensure, in accordance with the specifications, the operational maintenance and sustainability of all structures and equipment. In addition to the existing expertise, the project staff will receive appropriate on-the-job training in care and maintenance from CNE. In addition, community level technicians will be trained to complement the work-force at the respective sites.

Activity 3.4.2. Training and capacity building is a key project component in all the phases. In preparation for the operation and maintenance phase, considerable training and capacity building will be undertaken towards the end of the implementation phase. This will include the following:

- Short course for senior technical staff in operations and maintenance;
- On the job training for implementing teams in all aspects of operating and maintaining the projects;
- Training of community level project management committees in governance, leadership, group dynamics and other relevant topics; as well as basic operations and maintenance.
- Training of community level technicians for skills transfer to complement the project staff.

In particular, the operations and maintenance personnel will be trained (mostly on the job but also by CNE and the contractor) to equip them with skills that will enable them to:

- Operate the equipment;
- Service the equipment;
- Repair the equipment;
- Develop master plans with maintenance and multi-annual programs of work;
- To optimize costs of operating and maintaining the equipment;
- Minimise their damage and repair response time;
- To develop their own internal Training and capacity building program to upgrade their operations and maintenance staff ;
- Establish Internal Standard Operational Procedures which are documented in an operational manual
- Produce a technical reference manual which all the technicians can make reference to

Activity 3.4.3. Demonstration of a management and maintenance model

Preventive maintenance: Using measuring means developed significant values of operating parameters of a mechanical installation, electrical, hydraulic analyzing, or other time and is estimated to reach a threshold response area of safety technology.

Vibration analysis: It allows to collect, well before manifested the slightest perceptible sign physiologically, defect or drift value prior to the degradation of a moving part or defect: rolling, tightening, gear teeth, alignment, balancing, lubrication, electromechanical, wear, etc. The apparatus used is an accelerometer connected to an analysis software database with signals characteristic of all the ball bearings.

Oils Analysis: It measures changes in lubricating qualities, or insulating oils. This often costly analysis is justified only in the case of large amounts of oil (multipliers, processors), e.g. if a drain is carried out with periodic oil sampling and laboratory analysis. Analysis of insulating oils also helps to make a diagnosis on the active parts of the transformer.

Thermographic Analysis: It measures distance by optical viewfinder, the temperature of a room without touching:

- mechanical heating of bearings, shafts, gears, motors,
- overheating of electrical parts (under current); fault detection clamping connections, temperature coils, components, cables, contacts, insulation

The device used is a camera with infrared analyzer.

Systematic maintenance: Preventive maintenance can not be applied to all bodies or being too expensive, it must be coupled with a systematic maintenance. This requires a definition of the periodicities of each transaction, according to manufacturer data (sometimes questionable), analysis of past behavior of the system and "the rules of the art" ... which are enacted by observing large-scale behavior of a type of plan. This frequency should be recorded in a document maintenance schedule lined with operating specifications that records all transactions and provides, through its analysis, update the maintenance schedule:

- a. Systematic maintenance of intakes
- b. Maintenance systematic penstocks
- c. Routine maintenance of the turbines
- d. Systematic maintenance of electrical equipment
- e. Systematic maintenance of other entities:
 - Buildings (classic interview with a permanent concern of environmental noise, leakage, waste, electrical safety)
 - Items energy transport (poles, lines, substations)
 - Vehicles and equipment.

Component 4. Communication, management, public relations and promotion of investment

The objective of this component is to provide effective oversight of the project, provide visibility to the project and mobilize additional funding from public and private sources. This will broaden the impact of the project, especially in terms of future investors in the MHPP. Achieving this goal requires the necessary promotion and vulgarisation of MHP, through communication campaigns and, among others, the creation and management of a website for information on MHP.

The outcome is that public as well as private investments are mobilized to develop additional MHPP in the rural areas of the country, to reach 100 MW of installed capacity by 2020.

It will include a national program of communication and promotion in favor of MHP. This communication program is essential to the success of the project, since it determines the visibility of MHP nationally, towards investors but also to all stakeholders providing support to the development of MHP in DRC. The program will be planned and implemented along the whole project life. The design of the communication program will be entrusted to a specialized firm in the first phase of the project, and validated in close consultation with the PSC, with the project team.

The communication program will be developed so that its implementation ensures effective communication on the MHP during the project lifetime, and key broadly all relevant sectors: public and private sector, community organizations, NGOs, civil society, etc.

A National Information Centre on MHP will take the form of an interactive web platform managed and run daily by the management team of the project. This website is a key point of the communications program for MHP. It will link the various actors involved in MHP in DRC, and provide real-time information on project activities and the inventory of MHPP. It will broadcast on a large scale with the results of the first three components of the project, i.e. development of a regulatory and incentivized framework on MHP, technical documents to assist in the development of MHP, identified sites for the installation of new equipment, progress and lessons learned from the pilot investments, etc.

Output 4.1. A national program of communication and promotion for MHP is launched

Communication and promotion on MHP will be essential to the success of the project. Indeed, it will be the key to effectively spread information and knowledge on MHP at the national scale to all interested and concerned stakeholders, including local and national authorities, potential project developers, technical partners in the public and private sector, and the civil society (community organizations, NGOs, religious confessions, etc.). Moreover, it will provide a national and international visibility of MHP towards potential donors and investors.

As a consequence, the communication and promotion measures for MHP must be considered and planned comprehensively, both at the local and national scale.

Activity 4.1.1. A communication program is designed and tailored to MHPP

4.1.1.1. Recruit a specialized office to design the national communication program on MHPP: the design of the communication program on MHPP must take place early in the project implementation, in order to be carried out throughout the project duration. Terms of Reference for the recruitment of a specialized communication firm will be published during the inception phase of the project. The recruitment will take place with a close concertation between the Steering Committee and the Project Management Unit.

4.1.1.2. Design a communication program accompanied by an effective marketing plan to be validated during a stakeholder workshop: the recruited communication office will design a communication and promotion program for MHPP on the duration of the project, under the guidance of the PMU. This plan will have to include comprehensive working plan and budget.

The program will ensure that the Project regularly produces information and knowledge products related to MHPP, as well as project lessons and best practices, and disseminate these to target audience (e.g. project developers, community organizations, etc.) through means to be determined (newsletters, radio, trainings, technical documentation, and other appropriate media). Other than the training that will be conducted by the technology suppliers for the operators of the plants, the communication and promotion program will organize trainings on the different aspects of installation, operation and maintenance of MHPP facilities for selected representatives of communities and institutions.

4.1.1.3. Organize workshop to validate the communication program: the workshop will take place when the first draft of the communication and promotion program is ready. It will involve all

relevant stakeholders, and validate a final communication program to be implemented by the PMU.

Activity 4.1.2. Implement the communication program

The communication program will be implemented according to the working plan and budget set up and validated in Activity 4.2.1. It will have to provide specific outreach to all stakeholders, taking into account their particular needs and expectations. It will ensure an effective cooperation with all these stakeholders throughout the project.

The activity will help to disseminate MHPP information among stakeholders from public sector, private sector, community organizations, religious organizations, NGOs and civil society.

Output 4.2. : A national information center on MHPP is set up

The National Information Center on MHPP will be the key platform for the communication on MHPP. It will also actively contribute to capacity building of the stakeholders and to the monitoring of MHPP in the country. Finally, through the promotion of successful pilot projects and existing MHPP activities, the National Information Center will constitute a guarantee for potential investors in MHPP.

The National Information Center will take the form of an interactive website. It will be developed by a specialized marketing firm, in cooperation with key stakeholders, and daily run by the PMU.

Activity 4.2.1. Recruit a firm specialized in marketing to ensure the implementation of the output

4.2.1.1. Initiate the process of recruitment of the firm: Terms of Reference for the recruitment of a specialized marketing firm in charge of the website development for the National Information Center will be published during the inception phase of the project. The recruitment will take place with a close concertation between the Steering Committee and the PMU.

4.2.1.2. Contratualize the firm for a period of one year.

4.2.1.3. Develop an interactive web site on the promotion of MHPP: the recruited firm will be in charge of this development. The specifications for the website will follow detailed guidelines developed in Activity 4.2.1. in the national communication and promotion program. Needs of relevant stakeholders will be assessed and incorporated into the website design.

The website will be an accessible and interactive tool which will allow the regular publication of information, knowledge and lessons learnt on MHPP and on the implementation of MHPP in RDC, through various media (newsletter, technical and vulgarisation documents, videos, etc.). It will be complemented by a set of communication and network tools (dedicated blog, Facebook/Twitter page, RSS feed, etc.), in order to allow stakeholders to be regularly informed on the project and to provide comments and reactions.

The PMU will closely supervise the development of the website.

4.2.1.4. Lead a presentation and validation workshop for the website: this workshop will gather all relevant stakeholders so that they can issue comments and recommendations for a final version of the website, to be launched after the workshop.

4.2.1.5. Ensure vulgarisation of the website: this action will be conducted in parallel with outreach actions in Activity 4.2.2. above.

4.2.1.6. Manage the website: the PMU will be trained by the firm developing the website, in order to be able to daily manage and update the National Information Center until the end of the project. A regular and reactive management of the Information Center will be the key to its efficiency and impact.

3.5. Project indicators, risks and assumptions

The most direct global benefit of this project as it relates to the GEF objectives is the reduction in GHG emissions, chiefly CO₂. Other associated benefits to DRC include more access to clean energy for the rural communities; reduced deforestation and impacts on the environment from energy production; development of standards and guidelines on MHPP; more stable renewable energy supply and less-dependency on non-renewable energy sources. All these will contribute to the overall sustainability of the project and thus are critical to the continued reduction in CO₂ emissions.

The following indicators could be used to measure the impact of the proposed initiatives. The detailed indicators of the project, with a breakdown by outputs and activities, as well as baseline and target values, are provided in the Project Results Framework below.

Table 11: Indicators to measure the impact of proposed initiatives

Measurable Indicators	Source of Verification
Increased installed capacity of MHPP in the country, by 10 MW	MERH
Existing specific feed-in-tariff for MHP	MERH
20 000 new rural households benefiting from power supply	Provincial governments, MERH
Number of direct and indirect job created	Provincial governments
Number of women benefiting from the project	Provincial governments, MERH
10 new degrees created training engineers and technicians on MHP	Academic institutions
100 million USD additional investments in MHP from the private sector to reach an additional total installed capacity of 100 MW by 2020	FEC, banking sector, MERH

The proposed implementation of the project aims to allow multiple consistent results, with a replicable and sustainable approach. This does not go without risks. It is necessary to make an assessment of the elements that could prevent the proposed project from leading to the expected results, and also to anticipate a strategy for managing these risks in order to maximize benefits from the project.

Obstacles can be of different kinds: political (delays in decision-making or in providing information), institutional (management structures proposed in the project document inefficient),

technical (low potential for partnerships, complexity of project themes), environmental (potential deforestation in the future microcentrale areas) and financial (high costs, lack of attracted financial partners)

They can also meet various phases of the project: inception and recruitment phase at the beginning of the project, implementation of the activities, involvement of stakeholders, monitoring and adaptive management during the project, or sustainability and impacts of the project actions after the end of the project period.

Based on discussions with stakeholders, it is expected that the overall project risk will be moderate. The potential risks, which could hinder the successful project implementation and/or reduce project effectiveness, are itemized in the table below. To address these anticipated risks, the project will be designed to include an effective means to monitor, and to the extent possible, mitigate these risks. A project monitoring & evaluation plan has been prepared to track not only the project milestones, but also the indicators that will show that the identified risks are, if not eliminated – at least mitigated. Stakeholders were engaged during the project design stage. The measures that have been taken during the preparation and design of the Project and/or will be taken during the implementation phase so that these potential risks will be mitigated are also outlined in the table.

Table 12: Mitigating Risks

Type	Level	Risk	Mitigation
Policy and Legislative Risk	Moderate	<p>Not only the legislative processes are usually very cumbersome and it may take several months or years to complete one circle of legislation, but it may also occur that the texts are not implemented. This is the risk with the new law on electricity from June 2014. The proposed project may likely experience the following risks:</p> <ul style="list-style-type: none"> • Legislative delay that may go beyond the project life span. • Inability of members and low buy in of the Parliament to fully understand the entire concept of energy efficiency and the importance thus may not show much interest in the issues. • Slow/delayed adoption of the new law and policy by DRC, and non implementation of the existing laws. • The mandates of MERH and other relevant institutions to the project are not revised timely. This may pose a threat to the project. 	<p>The current project will put in place activities to adequately enlighten policy makers and legislators at the outset of the project to enable them understand the urgency and importance of promoting MHP.</p> <p>The PSC will be formed to provide an active platform for dialogue and to enlighten the lawmakers, industry and consumers on the cost-benefit of the project and opportunity cost of inaction.</p>
Technical Risk	Moderate	<p>The success of this project will largely depend on adequately increasing the technical capacity of the relevant institutions, such as the MERH, the CNE, the ANSER, the Provincial Governments, etc. The following are therefore potential risks:</p> <ul style="list-style-type: none"> • lack of project ownership • the willingness of the staff of these institutions to adopt new knowledge and practice • insufficient training of laboratories staff, manufacturers of MHP equipments, importers and retailers 	<p>Bottom-up, participatory training approach will be used to generate greater ownership. To mitigate this risk, adequate provision will be made to train staff of these institutions to imbibe the new technology.</p> <p>Training and enhancement of the capacity of relevant agencies and stakeholders is a key component of the current project.</p>

		<p>in the implementation of the labeling program</p> <ul style="list-style-type: none"> • lack of adequate training of key stakeholders to the project • inadequate training on procedures for O&MM on MHPP and enforcement procedures. 	
Economic and political Risk	Medium	<ul style="list-style-type: none"> • DRC is a country with huge natural resources. But at the same time, the economy is weak, and so is the power sector. The main power company, SNEL, is in a poor financial situation, and the incomes generated do not allow a sustainable and profitable activity. • Political upheaval and instability could affect economic development and the uptake of MHP technology 	<p>Political reforms are constantly being introduced to provide stability for economic growth that incorporate rural electrification and the power sector.</p> <p>This is considered a significant risk. The 2016 Presidential elections in DRC may be at risk if the Constitution is modified so as to enable the actual President to candidate for an additional 5-years mandate. Further significant outbreaks of violence are considered possible.</p> <p>The Eastern part of the country remains unstable.</p>
Financial Risk	High	<p>To promote MHP in DRC will require a significant investment on the part of the Government and other development partners. Therefore the likely risks to be associated with this project are:</p> <ul style="list-style-type: none"> • The Government and many of these development partners may be unwilling to put in this quantum of investment. • The unstable nature of the exchange rates of both local and foreign currencies and high interest rates. • The higher upfront cost of MHP (capital expenditures) may be a deterrent to developers and operators. 	<p>The project will put in place a strategic public-private partnership, complementing adequate structures, mechanisms, policy and legislation that will encourage investment in the sector.</p>
Marketing/Distribution Risk	Medium	<p>Insufficient numbers of rural households can purchase power from an energy provider.</p> <p>The anomalies in DRC's marketing/distribution system such as the proliferation of diesel generators, monopoly of distribution by SNEL, etc., may pose a potential danger to the success of the project. This makes the current business environment not conducive to the development of MHP.</p>	<p>This is considered relatively likely. Prior to implementing the program, conducted an extensive viability study, and in the course of the program all indications show that very large numbers of households will choose to purchase power in rural areas targeted by the project.</p> <p>This will be addressed by the current project by putting in place the right policy and legislation and setting up a stringent mechanism for enforcement.</p>
Information Risk	Low	<p>Though may be considered as low risks but they may impact on the project:</p> <ul style="list-style-type: none"> • There is low level of awareness on the potentials of MHP to bring about economic development and environmental sustainability. • There is also lack of thorough communication with key policy makers. 	<p>This will be addressed by creating knowledge products and awareness using all type of media (TV, radio, newspaper) and using NGOs already working on bioenergy projects.</p> <p>The implementation of a specific MHP policy will be included as a component of procurement</p>

		<ul style="list-style-type: none"> • More also, there is lack of an accurate reporting of existing legal and regulatory framework. • Illiteracy and general low capacity among households in target areas poses challenges in terms of data collection and impact measurement 	<p>policy to help the country adapt to the adoption of MHP.</p> <p>Using local CSO who has extensive experience of working with these types of households in DRC and in many other countries around the world. CSO will design the research tools to take into account respondent capacities, and minimize the risk of respondent incomprehension and bias.</p>
Climate Change Risk	Low	Climate change is predicted to cause changes and increase variability of DR Congo's hydrological regime and precipitation patterns, which will pose additional challenges and risk to MHP development	Results of climate models and remote sensing data such as TRMM (tropical rainfall measuring mission) can be used to monitor rainfall trends will be incorporated in the design and selection of pilot sites. The existing and projected climatic data will be used to ensure that the chosen sites are not highly affected by irregular rain trends and are least vulnerable to projected changes in hydrological regime. In addition, policy recommendations for MHP promotion will include regulations to protect watersheds in order to maintain the necessary vegetation and forest cover.
Overall Risk	Medium	The compilation of the different risks leads to an overall medium risk level	

3.6. Sustainability and replicability

The project is expected to set up a favorable context for the massive development of MHPP in DRC. More particularly, the project will define a regulatory and policy framework, establish the financial viability, building insurance, support services and management capacities for MHPP projects. The project will mark a new departure from the current situation of the energy sector in DRC, which is based on fossil-fuel energy, importations and central facilities, and does not take into account the socio-economic dimensions of the settlement areas, and the needs of rural communities in terms of access to clean and low-priced energy. This is the guarantee that the sustainability of the project will be provided to serve future generations.

Sustainability

Sustainability of the proposed project will depend upon various factors including the quality of the MHPP pilot projects implemented, the effectiveness of the legislative and institutional framework set up during the project, the successful implementation of the communication program on MHPP, and the technical assistance and capacity building program to ensure that all sectors involved gain full ownership of the tools and methods to be used. One of the purposes of this project is to stimulate sufficient demand for clean MHPP energy so that: (i) the use of MHPP-issued energy in the residential, institutional and industrial sector will become an accepted practice; and (ii) project developers and local communities will continue to invest in time, material and people to build a strong, local knowledge base.

By the end of this GEF project, sustainability of project results will be ensured by:

- Scaling up of MHPP pilot projects knowledge and lessons learnt, so that local actors in areas where there is a hydroelectric potential will develop and maintain new MHPP projects throughout the country;
- Establishing a National Center for Information on MHPP, run by the MERH, in charge of the dissemination of information and data on MHPP in DRC;
- Establishing a sustainable and efficient legislative and regulatory framework governing the development of MHPP projects in rural areas;
- Ensuring country ownership on the project results through a continuous involvement of institutional, technical and community stakeholders;
- Providing training to MHPP developers, operators, engineers, local and national authorities, community organizations;

More specifically:

- The project will provide mechanisms that allow the perpetuation of the actions proposed in this promotion program. While pilot MHPP projects will be financed by the GEF funding for this project, project activities will ensure that proposals for funding the development of future MHPP projects will be made both on the short and long-term. This will be one of the tasks of the public institution responsible for the promotion and financing of electrification in rural and pre-urban areas after the end of the project⁴⁵.
- Training to technology providers, that is to say, local manufacturers of turbines and other electromechanical equipment already operating in some provinces of the DRC⁴⁶, should be ensured. Thus, electromechanical industry and civil engineering specializing in building micro or mini hydropower plants will grow to fill the area with qualified staff adapted to the need for maintenance. It is recommended that such training programs incorporate legal economic and environmental dimensions in a direct line with sustainable development.
- A framework will be developed for the promotion of investment in mini or micro HPP, designed to inform potential investors about the attractiveness of the sector. Moreover, in the formulation of the promotion program on MHPP, duplication mechanisms and other structures will be defined and programmed to allow the scaling up and extension of pilot projects.

Regarding the project's financial sustainability, it is important to note that there will not be a need for a similar project in the future in the country once the identified barriers are removed. A change in regulation and adoption of a new set of rules for the energy policy and legislation of DRC – if done right – should be an irreversible process unless there is a major policy reversal that could not have been anticipated.

⁴⁵ Art 96 of Law n° 14/011 on the electricity sector.

⁴⁶ It is already the case in the provinces of Nord-Kivu, Sud-Kivu and Maniema.

Replicability

As the energy sector is being developed to better align productive capacity with demand for sustainable access to energy, rural MHPP initiatives will remain a key component of the DRC's strategy to provide sustainable energy to rural communities. By bringing together project developers and consumers, DRC will improve the efficiency of energy production and distribution in rural areas, while reducing its dependence to external, non-renewable energy sources, and mitigating the impacts of the energy sector on the environment. This demonstrates the relevance of the project that seeks to promote MHPP solutions and to set up a favorable framework for the continued development of rural MHPP projects.

The project intends to work closely with relevant professional and technical associations, national and local government agencies, consumer associations and other CBOs to remove technical, regulatory and informational barriers. Training workshops will be provided to private sector operators.

The project has a component to update policies and regulations on energy at the national level, to facilitate the identification and implementation of MHPP initiatives. The second component of the project will provide training and strengthen capacities of technical partners. The third component will develop pilot projects to demonstrate the technical and financial feasibility of MHPP. Finally, the fourth component will promote results from the first three components and influence project developers, institutions and rural communities on MHPP. It will provide assistance to technical parties of the energy sector and raise awareness on MHPP among civil society.

In terms of innovation, the technology is proved for more than a century worldwide. Still, the project will be a reference project for DRC, and its implementation will produce a multiplier effect for the widespread and large development of MHPP in the entire country. The implementation of the project will be an important phase in the electrification of the country, especially rural and remote areas.

The goal will be to develop successful pilot MHPP projects, and to sensitize consumers to the advantages of local, sustainable energy. If the demonstration effect for the pilot projects considered in this project can be successful, then a replicable model can be applied to other projects on a consensus basis between project developers, regulatory agencies and consumer groups. This could apply for additional 50 projects in the short to mid-term.

3.7. Global social and environmental benefits and GEF intervention rational

The project has strong economic effects because it reduces the dependence of DRC on imported fossil fuels and has a positive impact on the trade balance of the country.

This project will allow the economic and social development of different regions through direct job creation and use of local companies, and in improving the standard of living of the population. It will engender growth and sustainable development in several rural regions of DRC by producing electricity from a renewable source, and by creating employment.

The project will have many socio-economic benefits for local communities through the provision of electricity and thereby enabling the creation of new jobs. Across the country, the rate of access to electricity is about 9%.

On the social front, it has been amply demonstrated how important could be the provision of electricity in rural school children, improving public health and increase of income by providing income-generating activities in place of activities in the home. The overall impact of the project will be felt on many fronts by combining the advantages of substantial jobs, the production of green energy, improvement to the environment by the sequestration of significant quantities of CO₂ in the long-term and the reduction of large-scale CO₂ emissions by using hydropower, a local source of energy instead of imported fossil diesel.

The socio-economic benefits are among others:

- local investment related to the purchase of necessary materials and equipment;
- short-term jobs for local companies hired for numerous tasks;
- long-term employment in local villages for services related to O&M of energy systems;
- long-term revenue for villagers owning a parcel eligible for a MHPP;
- source of energy produced locally which will replace more expensive imported diesel fuel (which will improve the balance of payments of the country).

The project will be a showcase initiative for DRC. Local individuals who will operate the facilities will be trained on the processes and technologies related to small scale hydropower. The implementation of such a project will hence have a cumulative effect on such projects in other regions.

The project will have social benefits not only in rural communities but in mid-size cities in the provinces. Its implementation creates a number of new jobs both for highly skilled engineers and construction workers from different ethnic backgrounds and helps partially alleviate the unemployment problems in DRC in these urban areas. It contributes to the increase of reliability and availability of power supply service by enhancing the ability of the build new or rehabilitate existing small scale hydropower plants to provide critical electricity supply during peak times in small grids, and for frequency control.

The implementation of the project involves the development of sites identified to avoid further trouble for the environment, including the physical (hydrology, morphology, physico-chemical), biological (hydrobiology, fish fauna and fisheries wildlife and shoreline vegetation) and human (uses of water, landscape, noise, socio-economic environment and security). The next section provides a special focus on climate change mitigation, by looking at the emissions reductions of the project.

3.8. GHG emissions reduction

The lack of electricity in rural areas has forced people to adopt a variety of energy sources, the main ones being firewood, kerosene, diesel for generators, vegetable oils, etc. These energy sources and many others contribute to an increase in greenhouse gas emissions and deforestation⁴⁷. The development and implementation of MHPP will reduce the demand for biomass and greenhouse gas emissions.

⁴⁷ The removal of wood as an energy source for households and small businesses or the drying of food, etc.

Hence, this project will reduce greenhouse gas (GHG) emissions – estimated hereafter – by the substitution of fossil fuels with hydropower for the production of electricity. It aims at increasing generation capacity, efficiency and reliability of hydropower generation and enhancing the ability of MHPP to provide critical electricity supply in rural areas where in many cases diesel generators are utilized. The project is expected to result in a 10 MW increase of the installed capacity, mostly by substituting the use of fossil fuels or wood by hydropower, a clean and none emitting source of energy. Very little GHG's shall be produced by the project, hence it will ultimately result climate change mitigation.

Calculation of GHG emissions reduction

The electricity will be generated in each site by a hydropower plant with an installed capacity comprised between 20 kW and 2 MW. The plant will be in most of the cases a run-of-the river type, and in some case, there will be a reservoir. The production and distribution of electricity will be managed by local communities or private companies.

In order to assess the amount of GHG emissions that will be avoided by the project against the baseline scenario, the following UNFCCC methodology is applied to the project: *ACM0002, Consolidated baseline methodology for grid-connected electricity generation from renewable sources*. This methodology includes three tools: i) an approved consolidated baseline, ii) a tool to calculate the emission factor for an electricity system, iii) a combined tool to identify the baseline scenario and demonstrate *additionality*.

The calculation method considers electricity capacity editions from run-of-river hydropower plants and hydropower projects with existing reservoirs where the volume of the reservoir is not increased, in case of rehabilitation.

Baseline

In the absence of the project, the rural population is expected to continue to use electricity from diesel generators injected into the grid at historical average levels.

The technical lifetime of a typical hydropower plant is estimated to be between 50 and 100 years. Hydropower plants in DRC are not an exception and are also characterized by a relatively long technical lifetime. For example, one of the oldest plants in DRC has been in operation since 1915 in the Bas Congo province, but does not operate since 1976. Other hydropower plants operate well, although with lower efficiency than a modern hydropower plant.

The plant personnel has developed a special maintenance and operation plan that involves partial annual maintenance measures, complete check-up and maintenance of the turbine equipment at intervals of at most five years and of electric equipments at most every ten years. This overall maintenance and operation plan and the extremely high level of expertise of the plant personnel have allowed the plant to continue uninterrupted operation up to the present.

The positive impacts of the MHP projects will be in the reduction of CO₂ emissions by reducing fuel consumption and firewood currently used for lighting and cooking. Negative impacts such as those on the flora and fauna in the bed of the river and the canals will be mitigated accordingly.

Non negative effect on communities and indigenous peoples are stable and involved in the project. Benefits should be distributed equitably to all segments of the population, regardless of ethnicity. Calculations substitution of imported fossil fuels with renewable energy through MHP

systems would be needed to show that the average cost of local production per kilowatt hour will be far less than the liter of diesel purchased in rural areas.

The amount of CO₂ emissions will ultimately depend on the topography of the tank volume, materials used for construction, the local climate, etc.

Assumptions of production and materials proposed in the installation of MHP systems are as follow: SO₂: 30.72 kg / mW, NO₂: 30.72 kg / MW equivalent CO₂: 8,748.84 kg / MW.

With the implementation of the project, 87,490 kg CO₂ equivalent per year will be avoided by replacing fossil fuel generators with MHP. The project implementation leads to an increase in the renewable electricity generation capacity of DRC and a reduction in the emission of SO₂, NO_x and CO₂ from the diesel generators, oil lamps and traditional cook-stoves using forest wood and charcoal, which would have to be operated in the absence of the project.

Direct: Installed capacity 10 MW

$$CO_{2_direct} = e * I * c$$

- o e: Annual energy replaced: Assuming an average capacity factor of 50% = 43,800 MWh/year
- o I: Average useful lifetime in years = to be conservative, 20 years (even though the installation will last more).
- o c: CO₂ intensity of the marginal technology, diesel generation, at 0,786 tCO₂e/MWh

$$CO_{2Direct} = 43,800 \text{ MWh/y} * 20 \text{ years} * 0,786 \text{ t CO}_{2e}/\text{MWh} = 688,536 \text{ tons CO}_{2} \text{ eq}$$

Direct post-project: The project does not include activities (e.g., a Fund) that would result in direct post-project greenhouse gas emission reductions.

Indirect: Using the GEF bottom-up methodology, indirect emission reductions attributable to the project are 1,377,072 tonnes of CO₂ equivalent. This figure assumes a replication factor of 2.

According to the Manual, Approach 2a-Top-down information but with a bottom-up methodology, that is: CO₂indirect TD= CO₂ TM * CF

Thus, the CO₂Indirect Top Down reductions are:

$$30 \text{ MW} * 8760 \text{ h} * 50\% * 0,786 \text{ tCO}_{2}/\text{MWh} = 103,280 \text{ tCO}_{2} \text{ eq/y}; \text{ and during the 20 years of lifetime of the investment, } 2,065,600 \text{ tCO}_{2} \text{ eq.}$$

As a summary, the estimated Direct and Indirect reduction of CO₂ eq emissions is:

Table. GHG emissions reduction

Time-frame	Direct project	Indirect post-project (bottom-up)	Indirect post-project (top-down)

Total CO ₂ emissions reduced (tons)	688,536	1,277,072	2,065,600
Unit abatement cost of GEF funds	\$4.6	\$2.4	\$1.5

3.9. Cost effectiveness

The proposed project targets the realization of a substantial improvement in the management of natural and energy resources for the provision of energy services in DRC facilitated through the barrier removal activities focusing on institutional strengthening, regulatory framework, capacity building, market development, communication and promotion, and other technical assistance activities that will be implemented.

During the project inception phase, targeted consultations will be held with local entrepreneurs to participate in the demonstrations projects, through investments in land, premises and hardware of the projects. Also, Component 4 of the proposed project focuses strongly on specific development and implementation of a roadmap for communication and promotion on MHPP, while Component 1 focuses on the implementation of an appropriate institutional and regulatory framework for the effective development of MHPP projects. These actions will be complemented with recommendations for fiscal incentives from the Ministry of Finance, as well as earmarked areas for MHPP energy production.

As part of the project to promote the micro hydropower, selected pilot sites are selected and the number 39 shared out in 11 provinces of the Democratic Republic of Congo. These sites to be supported and benefit from the implementation could be financially, socio-economic and environmental viable.

The analysis of financial viability is a crucial step in the evaluation of projects. It allows the sponsor and capitalist financial institution, brief, holders of capital to realize the financial profitability of the project, the recovery of funds invested in the project after a reasonable period.

To perform the analysis of the financial viability of 40 micro-hydro sites, it is recommended the use of RETScreen⁴⁸ software that is best suited for the analysis of small hydro. Its objective is to first determine if the potential for exploitation of a site is interesting enough to deserve to continue with a more detailed financial review. Otherwise, the site must be abandoned in favor of other options. It gives an overall idea about the socio-economic and environmental financial viability, prior to a more detailed analysis of the project.

The RETScreen⁴⁹ model that has been developed by the Canada Natural Resources Ministry, has received the support of UNEP, NASA, the GEF and REEEP for its development and its wide distribution in various applications.

⁴⁸ RETScreen International: www.etscreen.net

⁴⁹ The RETScreen model for small hydropower projects contains seven sheets of calcium: (1) The energy model, (2) hydrological analysis and load calculation (hydrology and load), (3) the characteristics of the equipment (equipment), (4) cost analysis, (5) analysis of greenhouse gas emissions (GHG analysis) reduction, (6) the financial summary and (7) the sensitivity analysis and risk (sensitivity).

The analysis of the financial viability was conducted in sixth step of RETScreen which provided financial parameters, the summary cost savings and project revenues and annual cash flow. To confirm that a particular site is financially viable, it will read the values of profitability indicators below:

- i) Net Present Value (NPV) must be positive;
- ii) the time of recovery of capital (Back Single) should be short;
- iii) Internal Rate of Return (IRR) must exceed the cost of capital.

For information, within the framework of the promotion of micro-hydropower, it was analyzed the financial viability of the following sites:

- a) The site of Mahango Ivugha (Groupement de Ngulo, Chefferie de Baswagha dans le territoire de Lubero) in North-Kivu province.
- b) The micropower of Chibayu to Bitale, Bunyakiri Kalehe Territory, South-Kivu province,
- c) The site of Mbankana on Lufimi river in Bandundu province.

The treatment of technical, economic and financial data RETScreen proves that the three sites are financially viable. For the first two sites, it was used the first method 1 and to the third method 2. This allowed for the last, especially, to develop the following elements: (1) the energy model; (2) hydrological analysis and load calculation (hydrology and dependents); (3) cost analysis; (4) the financial summary (financial sustainability); (5) the graph of cumulative financial flows.

Table 13: Parameters of financial viability

Sites	Territory/ Provinces	RETScreen Method used	Life Project (years)	VAN	IRR (%)	Payback period	Financial Viability
Mahango	Lubero/ Nord-Kivu	Method 1	40	-	10,7	13,3	YES
Chibayi	Kalehe/Sud-Kivu	Method 1	40	-	25,0	3,0	YES
Lulua	Kasai-Occidentale	Method 2	40	467.276	16,2	6,5	YES

From the elements of this table, we can conclude that the Mbankana site is financially viable. To carry out the assessment of the financial viability of all sites Chosen, project coordination will recruit two consultants (an engineer and a socio-economist) to study the financial and socio-economic viability of the sites to be developed in detail.

The socio-economic viability of the MHPP will be apprehended from the primary effects (direct, indirect) and secondary (induced) projects on the community ie analysis of the economic impact on the nation or any other group.

The objective of the economic analysis is to evaluate the project from the perspective of the national economy (or any other group) and take into account all the constituent agents of the economy (households, businesses, public institutions and world outside).

Infrastructure development of micro hydropower can not only generate economic activity, but also offers better integration and social protection. Positive social impacts of the project will contribute to economic growth and poverty reduction by reduced electrical energy costs of households and the removal of constraints of energy for SMEs that offer employment opportunities for the poor.

Direct benefits will be observable in all categories of electricity consumers served by the project, including the poor and vulnerable groups. Benefits include access to electricity previously not available to households, better lighting quality at cheaper prices than those required for kerosene and / or diesel; and improved air quality in homes, the development of small economic activities (refills phone batteries, opening mills for cassava and maize, supplies electricity to small bars and restaurants neighborhood, etc.).

The poor and vulnerable consumers, as well as social services such as schools and clinics, are often particularly disadvantaged by inadequate energy supply or poor quality of electricity supply; see a total lack of energy supply. However, they will directly benefit from the project.

Regarding indigenous people, there are Pygmy minorities in DR Congo, locally called “autochthon population”. There are between 450,000 to 600,000 Pygmies in the country⁵⁰, living in the high forest regions. However, this project is not likely to have an impact on them. Most of them live in very remote parts, even far from villages. However, if it occurs during project implementation that a potential site is nearby their habitats, the project will ensure that their interest and participation are fully taken into account.

The project is expected to benefit nearly 879,162 people, about 90% are considered poor (living on less than 1USD/day). Since there is no existing network in rural areas where are located in the proposed project site, the demand for the service is very high given the convenience and efficiency account associated with electrical energy.

However, comprehensive studies to achieve feasibility, it will take into account the willingness and ability of households to pay for the service. To enable all households, small businesses and institutions in a defined projects to be connected to the facilities department, the Government should step in to subsidize connection costs (particularly true of the transportation and connection) to allow all households small businesses and institutions within a defined radius projects be served.

The implementation of the selected sites followed by the access in rural areas, due to the easy availability of roads, there will be large business opportunities with high demand for skilled labor and unskilled. The project itself will create employment for a considerable number of people during the phase of implementation, operation and maintenance.

Finally, there are many opportunities for SMEs and individual workers to participate in and benefit from the implementation of the proposed project. Areas where SMEs and individual job roles are planned include:

- Provision of transport services;
- Availability of skilled labor and unskilled (eg, masons and builders, carpenters);
- Construction companies;
- Local retailers / wholesalers (eg, cement, cables, bricks)
- Maintenance of the canal;
- Road maintenance;
- Suppliers of electrical equipment;

⁵⁰ Source : CIFOR, Banque mondiale et CIRAD (2007), op. cit.

- Suppliers and manufacturers of spare parts;
- Companies providing services to recharge batteries;
- Establishment of small businesses that arise following the development of electricity infrastructure and the availability of electricity (the *quado* service, mills, etc.).

Facilities management will be assigned to different local communities, in the case of a community project, which will be set up in technical collaboration with MERH and MEDD as supervisory institutions and management (marketing of electricity) to the operation and maintenance of facilities and equipment, including personnel assigned to these operations.

During the operation and maintenance phase, a total of 8 full-time staff will be responsible for certain tasks of each plant. The activity on the procurement plan of the project will ensure the transparent supply of works, goods and services across national calls for international/national consultant proper case according to various products.

Summary and detailed feasibility studies and elements of the implementation phase, for example, will be carried out by national calls for international/national consultants, while construction operations, maintenance and equipment maintenance will be carried out through a national competitive bidding process.

To ensure professionalism in the operation and maintenance phase, the project will be managed by qualified staff and project supervised by the MERH and MEDD unit project management.

To improve governance, the community will have a local management committee which will also ensure accountability to senior project hierarchy. The local management committee will be responsible for establishing the law of supply of electricity by site, the law of water management, plans, licenses and standards of water quality, distribution followed by recovery.

Another activity is to develop the capacity of all persons involved in the management, operation and functioning of MHPP. This activity will be carried out throughout the duration of the project, including the training of technicians' community level to improve the sustainability of the project and allow the community to understand the management of long-term project.

Permanent operations staff must come from the community (a total of 8 persons is considered for each project site: plant operators, billing and revenue drivers, secretaries, custodians). Employment for the entire project will be made on a non-discriminatory basis. Positive action will be used to ensure the inclusion of equality. The project will ensure that 30% of employees and team decision-making are women. Keeping in mind that gender issues are specific to each country and culture, the inclusion of equality strategies need to be observed during the development phase of the project. These are:

- take proactive measures to identify women for MHP activities installation and operation and maintenance;
- take account of the needs assessment and gender equality in the feasibility studies of MHP projects;
- Gender-sensitive fix for sub-projects budgets;
- Incorporate an explicit equality in training materials focus;
- Using gender-sensitive indicators and sex-disaggregated data wherever appropriate to set targets and performance reporting.

Currently, fossil fuels and firewood are the most used for lighting and cooking in rural areas. Not only do these sources give rise to high CO₂ emissions, they also lead to the depletion of natural

resources. The smoke from these sources is associated with upper respiratory tract disease. It is expected that the power generated from the project sites is able to meet 100% of the lighting needs of beneficiaries, among other uses.

Hydropower is a cleaner source of energy, there will be an increased health benefit for consumers. The savings from the cost of fossil fuel and time savings in terms of power convenience are among the benefits. Supplementary expected by small businesses within the project area or site, mainly food processing plants and cold rooms, in addition, can be expected to create employment for women and youth in the areas income.

Environmental studies will focus on aspects related to vegetation, land use, archaeological / cultural sites, noise, water quantity and quality, noise and traffic, reducing the consumption of fossil fuels.

Unlike large hydropower projects with reservoirs and dams, MHP proposed systems are systems with little negative impact on the environment or the social fabric of the beneficiary communities, for example, no displacement of communities, no abandonment of fields operated, no overflow of water, etc.

Cost efficiency in the connection to the network: With mission's provinces, 39 sites totaling 10.029 MW were selected. The implementation of these sites will create 468 permanent jobs (12 people per site) and 780 temporary jobs (20 people per site). The total cost for the implementation of these sites is 29,253,500 USD.

A total of 879,162 people will receive electricity with implementation of this project. There will be around 146,027 households and 500 businesses connected locally. If the project holds six sites for a first experimental phase, 62 permanent and 120 temporary jobs will be created. The main statements of the MHP should include:

- the revenue from electricity sales price to be fixed by law and demand or according to the law;
- avoided costs of energy from generators replaced by the new MHPP; government subsidies to provide electricity services to a specific area or group (s) the consumer;
- Performance liquidation equipment replaced;

Finally, the benefits of the project will be provided at both national and provincial level, including additional taxes, industrial development and infrastructure improvements. To bring order in this sector in terms of revenue, a consultant will conduct appropriate studies to propose a list of acts that could be improved to tax and non-tax revenues, specifying those to mobilize in nationally and provincial or local terms.

The MHP systems should support the following financial costs:

- Construction, cost of operation and maintenance;
- Maintenance of equipment after a set period and for the rehabilitation of civil engineering structures where it is necessary fees;

Direct jobs part time on selected sites are estimated between 240 people by site whose mission preparation and maintenance of access roads to the site, site preparation for the construction plan, transport equipment on MHPP sites, the construction and installation of equipment for MHPP (masons, architects) and in order to direct the work of carpenters and supply of construction materials.

Direct employment in MHP requires the presence of these people at determined position following:

- Site management: 1
- Administration site: 1;
- Production staff: 2;
- technical staff: 2;
- A cashier and a secretary: 2;
- Sentinel: 2
- Recovery: 2

The part-time jobs can also reach 20 people by site:

- Maintenance channel: 2;
- Road maintenance: 5;
- Field staff maintenance: 5
- Community workers: 5
- Public relations, marketing and promotion of the project: 3.

3.10. Gender issues

The majority of the beneficiaries of mini- and micro-hydropower in rural areas are end users. Providing energy access to these most often poor households adds value to agricultural production and to micro, small and medium enterprises. It generates high positive impacts on women as consumers of electricity. While electrification will benefit both women and men by enhancing their engagement in more productive activities, gender gains are derived mainly from reducing the workload of women and girls. The impacts are lower for women in terms of employment in MHPP. Very few women are presently involved in infrastructure development and power distribution, and this might not significantly change with the project.

4. Logical framework

Project title: Promotion of mini- and micro-hydropower plants in DRC								
Project Objective: To promote investment in mini and micro hydropower (MHP)-based mini-grids for rural electrification in the Democratic Republic of Congo								
Indicator: The Congolese State increases the access to energy for the benefits of the rural population in regions not connected to the national grid by increasing the installed capacity of MHP by 10 MW. Electricity generation: 43,800 MWh/year / 219,000 MWh at project completion / 876,000 MWh at technology lifetime Total CO2 emission reduction: direct project of 688,536 tons Number of people benefitting from the project: 879,172								
Sources: Project baseline reports; Project annual execution reports; Project execution monitoring reports; Project final evaluation report.								
Component objectives and outcomes	Outputs	Activities	Performance Indicators			Sources of Verification	Risks and adaptation measures	
			Indicators	Baseline (2015)	Target (2020)			
Component 1: Policies and regulatory and institutional framework for private and community-based investments in mini grids supplied by small scale hydropower								
Outcome 1. Enabling policy and institutional framework for MHP-based mini-grids set up	1.1. An institutional and regulatory framework for rural electrification by MHP is set up	1.1.1.	The institutional framework (national and provincial levels) and the Regulatory Agency of the electricity sector are strengthened	- By the first half of 2015, a decree on the establishment, composition, organization, powers and functioning of the two agencies	Law from June 17, 2014	Decrees enabling a full and comprehensive application of the law	- Decree - Installment report	<u>Risks:</u> - Cumbersome administrative - Non-compliant profile of nominees - No consideration of gender in the selection of nominees <u>Measures:</u> - Appointment of a ministry leader for monitoring - Lobbying government - Definition of objective criteria for designating appropriate individuals
		1.1.2.	The establishment and operationalization of the public entity in charge of the regulation and the one in charge of the promotion of renewable energy in rural areas, for both national and provincial levels are supported	- Gender sensitive rural electrification framework is in place and fully implemented				
		1.1.3.	Electrification and Development Local Committees (CLED) in the pilot sites are established and operational.					
		1.1.4.	The development of regulations implementing the					

		<p>law of the electricity sector is supported</p> <p>1.1.5. The development of normative acts of the Regulatory Authority and those of the Public Establishment promoting Rural and Peri-urban Electrification are enabled through the project</p> <p>1.1.6. A national diagnostic study is launched to support the establishment of a Legal, Fiscal and Administrative system of MHPP sector in DRC</p>					
	<p>1.2. A National Policy for the Electricity sector is developed, adopted and disseminated and a new legal framework is designed and aligns them.</p>	<p>1.2.1. The process for a National Policy for the Electricity sector is launched.</p> <p>1.2.2. The National Policy for the Electricity sector is published and disseminated.</p> <p>1.2.3. The revision of the legal framework and the alignment of the new texts on National Electricity Policy for MHP is ongoing.</p> <p>1.2.4. Advocacy bodies legislating on the need for a new legal framework are campaigned</p>	<p>- Gender sensitive National Policy for the Electricity Sector in place and fully implemented</p>	<p>No clear policy</p>		<p>- Policy - Installment report</p>	<p><u>Risks:</u></p> <ul style="list-style-type: none"> - Cumbersome administrative - Non-compliant profile of nominees - No consideration of gender in the selection of nominees <p><u>Measures:</u></p> <ul style="list-style-type: none"> - Appointment of a ministry leader for monitoring - Lobbying government - Definition of objective criteria for designating appropriate individuals

	1.3. A specific program for capacity building of national supervisory bodies of MHPP is set up and executed annually	1.3.1. An annual program of Capacity Building is established as well as the exchange of experiences in favor of the parent bodies of the electricity sector, MHPP project developers, and CLED. 1.3.2. The development of the national rural and peri-urban electrification plan is supported	- MHE is a priority for the Government of DRC				<u>Risks:</u> - Lack of real incentive in the OBA mechanism - Changing feed-in-tariffs <u>Measures:</u> - Securing the PPA for any investors
	1.4. An OBA scheme is designed, launched in pilot phase and is then adopted as a strategy for financial assistance to MHPP developers	1.4.1. An OBA pilot scheme is defined and launched 1.4.2. OBA patterns are incorporated in standardized assistance to MHPP 1.4.3. OBA scheme are generalized	- Specific financial incentives for MHP - number of MHPP operators who benefit of the scheme	0 0	1 1	- Decree - Installment report	<u>Risks:</u> - Cumbersome administrative profile of nominees - No consideration of gender in the selection of nominees <u>Measures:</u> - Appointment of a ministry leader for monitoring - Lobbying government - Definition of objective criteria for designating appropriate individuals
Component 2: Reinforcement of the technical capacities in the technological supply chain							
Outcome 2: Capacity for delivering turnkey solutions and	2.1. Technological barriers are identified	2.1.1. Needs in the provincial technical institutes in terms of MHPP are assessed	- number of new engineers specialized in MHP				

quality O&M&M services for MHP		2.1.2.	A technology transfer framework is in place in the MHP supply chain					
		2.1.3.	Financial support is provided to NGOs to carry out some existing MHPP projects requiring O&M capacity building					
		2.1.4.	Support to technical and professional institutes is provided for the development of modules, training programs and eventually degrees					
	2.2. Technical assistance is provided to local small operators	2.2.1.	General trainings are given to local small operators	- A training plan is developed and approved by the Steering Committee;	0	At least 500 managers/ executives (men and women)	- Training plan - Training reports - Project annual reports	<u>Risks:</u> - Appointment of persons not appropriate - Delays in issuing the no-objection notice by donors <u>Measures:</u> - Development of objective criteria - Anticipation of possible implementation delays of the training program
		2.2.2.	O&MM specific trainings are given to local small operators	- number of local small operators trained				
		2.2.3.	Community organizations receive technical assistance on MHP					
		2.2.4.	Educational partners receive technical assistance on MHP					
		2.2.5.	Trainers are trained					
		2.2.6.	A training manual is prepared					
	2.3. Technical capacities of local manufacturers, service providers and operators are reinforced	2.3.1.	The rural electrification authority is supported to promote MHP	- number of participants to the advanced training programs - increase in the number of local manufacturers	0	At least 500 managers/ executives (men and women)	- Training plan - Training reports	<u>Risks:</u> - Appointment of persons not appropriate - Delays in issuing the no-

		2.3.2. Advanced training programs are proposed to operators and developers of MHPP				- Project annual reports	objection notice by donors <u>Measures:</u> - Development of objective criteria - Anticipation of possible implementation delays of the training program
	2.4. Technical advisory services and management support are provided for MHPP developers and end users.	2.4.1. Technical advisory services are proposed to potential local investors, operators, etc. 2.4.2. User management and commissioning of technical advice is given 2.4.3. Long-term capacity building program is secured for the promotion of MHPP	20 million USD additional investments in MHP from the private sector	0	Investment in MHPP		<u>Risks:</u> - Delays in investing in MHPP - Delays in the adoption by the Government of tariffs <u>Measures:</u> - Anticipation of delays on completion deadlines for MHPP development
Component 3: Pilot investments in selected small scale hydropower stations in rural communities							
Outcome 3: Improved confidence in the technical and financial viability of MHP-based rural electrification	3.1. Pilot sites are identified and validated for development	3.1.1. A plan for the development and implementation of the selected sites is available. 3.1.2. The calendar for the development and implementation of the selected sites is established	Increased installed capacity of MHP in the country, by 10 MW Existing specific feed-in-tariff for MHP	20 MW installed capacity	30 MW installed capacity	10 new MHPP	<u>Risks:</u> - Delays in the development of MHPP - Delays in the adoption by the Government of tariffs <u>Measures:</u>

							- Anticipation of delays on completion deadlines for MHPP development
	3.2. Selected MHPP sites are developed	3.2.1. The full project development cycle is undertaken to implement several selected MHPP	Increased installed capacity of MHP in the country, by 10 MW Existing specific feed-in-tariff for MHP	20 MW installed capacity	30 MW installed capacity	10 new MHPP	<u>Risks:</u> - Delays in the development of MHPP - Delays in the adoption by the Government of tariffs <u>Measures:</u> - Anticipation of delays on completion deadlines for MHPP development
	3.3. Selected sites are implemented and constructed, leading to additional 10 MW of MHP-based power generation capacity	3.3.1. Procurement documents lead to the construction phase of several selected pilot sites	Increased installed capacity of MHP in the country, by 10 MW Existing specific feed-in-tariff for MHP	20 MW installed capacity	30 MW installed capacity	10 new MHPP	<u>Risks:</u> - Delays in the development of MHPP - Delays in the adoption by the Government of tariffs <u>Measures:</u> - Anticipation of delays on completion deadlines for MHPP development

	3.4. Selected MHPP are operationalized	<p>3.4.1. Technical assistance is provided in the selected sites on an O&MM plan</p> <p>3.4.2. Trainings are provided for the operators of the selected sites</p> <p>3.4.3. A management and maintenance model is demonstrated as efficient and operational</p>	Increased installed capacity of MHP in the country, by 10 MW Existing specific feed-in-tariff for MHP	20 MW installed capacity	30 MW installed capacity	10 new MHPP	<p><u>Risks:</u></p> <ul style="list-style-type: none"> - Delays in the development of MHPP - Delays in the adoption by the Government of tariffs <p><u>Measures:</u></p> <ul style="list-style-type: none"> - Anticipation of delays on completion deadlines for MHPP development
Component 4: Communication, management public relations and promotion of investment							
Outcome 4: Increased awareness about MHP potential and investment climate	4.1. A national program of communication and promotion for MHP is launched	<p>4.1.1. A communication plan tailored to MHPP is designed</p> <p>4.1.2. The communication plan is implemented</p>	20 000 new rural households benefiting from power supply	10% electrification in rural areas	Increased electrification rate in rural areas		
	4.2. A national information center on MHPP is set up	4.1.3. The functioning of the national communication center is defined with the support of a specialized consultancy	20 000 new rural households benefiting from power supply	10% electrification in rural areas	Increased electrification rate in rural areas		

5. Total budget and Pluri-annual work plan

Award ID:	00087442	Project ID(s):	00094434											
Award Title:	GEF PIMS 4690 Micro Hydro DR Congo													
Business Unit:	COD10													
Project Title:	Promotion of mini & micro-hydro power plants in DR Congo													
PIMS no.	4690													
Implementing Partner (Executing Agency)	Ministry of Energy and Hydraulic Resources (MERH)													
Components	Responsible party	Source of Funds	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount (USD)	Amount (USD)	Amount (USD)	Amount (USD)	Amount (USD)	Amount (USD)	Notes		
						Year 1	Year 2	Year 3	Year 4	Year 5	Total			
1. Policies and a regulatory and institutional framework for private and community-based investments in mini grids supplied by small scale hydropower	MERH	62000	GEF	71200	International Consultants	40,000	40,000	30,000	20,000	20,000	150,000	a		
		62000	GEF	71300	Local consultants	40,000	40,000	40,000	30,000	30,000	180,000	b		
		62000	GEF	71600	Travel	10,000	10,000	10,000	10,000	10,000	50,000	c		
		62000	GEF	72200	Equipment & Furniture	10,000	10,000	10,000	10,000	10,000	50,000	d		
		62000	GEF	72600	Grants	200,000	100,000	100,000	100,000	100,000	600,000	e		
		62000	GEF	74200	Audio Visual & Print Prod Costs	15,000	10,000	10,000	10,000	10,000	55,000	f		
		62000	GEF	75700	Training, workshop, meetings	10,000	10,000	10,000	10,000	10,000	50,000	g		
		62000	GEF	74500	Miscellaneous	3,000	3,000	3,000	3,000	3,000	15,000	h		
		Total GEF Outcome 1						328,000	223,000	213,000	193,000	193,000	1,150,000	
		4000	UNDP	72100	Contractual Services - Companies	10,000	10,000	10,000	10,000	10,000	50,000	i		
		4000	UNDP	71400	Contractual Services - Individuals	10,000	10,000	10,000	10,000	10,000	50,000	j		
		Total UNDP Outcome 1						20,000	20,000	20,000	20,000	20,000	100,000	
		Total Outcome 1						348,000	243,000	233,000	213,000	213,000	1,250,000	
2. Reinforcement of the technical capacities in the	MERH	62000	GEF	71200	International Consultants	5,000	10,000	10,000	10,000	10,000	45,000	k		
		62000	GEF	71300	Local consultants	10,000	10,000	10,000	10,000	10,000	50,000	l		
		62000	GEF	71600	Travel	5,000	10,000	10,000	10,000	10,000	45,000	m		

technological supply chain		62000	GEF	72100	Contractual Services-Companies	10,000	20,000	20,000	20,000	20,000	90,000	n		
		62000	GEF	75700	Training, workshop, meetings	3,000	3,000	3,000	3,000	3,000	15,000	o		
		62000	GEF	72200	Equipment & Furniture	22,000	50,000	50,000	30,000	30,000	182,000	p		
		62000	GEF	74500	Miscellaneous	3,000	3,000	3,000	3,000	2,669	14,669	h		
		Total GEF Outcome 2					58,000	106,000	106,000	86,000	85,669	441,669		
		Total Outcome 2					58,000	106,000	106,000	86,000	85,669	441,669		
3. Pilot investments in selected mini- and micro-hydropower stations in rural areas	MERH	62000	GEF	71200	International Consultants	20,000	20,000	30,000	20,000	15,000	105,000	q		
		62000	GEF	71300	Local consultants	15,000	15,000	20,000	20,000	20,000	90,000	r		
		62000	GEF	71600	Travel	10,000	15,000	15,000	15,000	15,000	70,000	s		
		62000	GEF	74200	Audio Visual & Print Prod Costs	5,000	10,000	10,000	10,000	10,000	45,000	t		
		62000	GEF	75700	Training, workshop, meetings	10,000	10,000	10,000	10,000	10,000	50,000	u		
		62000	GEF	72100	Contractual Services-Companies	50,000	150,000	150,000	150,000	125,000	625,000	v		
		62000	GEF	74500	Miscellaneous	3,000	3,000	3,000	3,000	3,000	15,000	h		
			Total GEF Outcome 3					113,000	223,000	238,000	228,000	198,000	1,000,000	
			Total Outcome 3					113,000	223,000	238,000	228,000	198,000	1,000,000	
4. Communication, management, public relations and promotion of investment	MERH	62000	GEF	71200	International Consultants	0	5,000	5,000	10,000	10,000	30,000	w		
		62000	GEF	71300	Local consultants	5,000	15,000	15,000	20,000	20,000	75,000	x		
		62000	GEF	71600	Travel	5,000	9,000	10,000	15,000	15,000	54,000	y		
		62000	GEF	72400	Communic & Audio Visual Equip	30,000	30,000	50,000	50,000	50,000	210,000	z		
		62000	GEF	75700	Training, workshop, meetings	10,000	15,000	15,000	15,000	15,000	70,000	aa		
		62000	GEF	74500	Miscellaneous	3,000	3,000	3,000	3,000	3,000	15,000	h		
			Total GEF Outcome 4					53,000	77,000	98,000	113,000	113,000	454,000	
		4000	UNDP	72100	Contractual Services - Companies	10,000	10,000	10,000	10,000	10,000	50,000	bb		
		4000	UNDP	71400	Contractual Services - Individuals	10,000	10,000	10,000	10,000	10,000	50,000	cc		
			Total UNDP Outcome 4					20,000	20,000	20,000	20,000	20,000	100,000	
			Total Outcome 4					73,000	97,000	118,000	133,000	133,000	554,000	
	MERH	62000	GEF	71300	Local consultants	10,000	10,000	10,000	10,000	10,000	50,000	dd		

Project Management	62000	GEF	71600	Travel	4,000	4,000	4,000	4,000	4,000	20,000	ee	
	62000	GEF	72200	Equipment & Furniture	4,000	2,000	2,000	2,000	2,000	12,000	ff	
	62000	GEF	74100	Professional Services	3,000	3,000	3,000	3,000	3,000	15,000	gg	
	62000	GEF	74599	Direct Project Cost	7,000	7,000	10,000	10,000	10,000	50,000	hh	
	62000	GEF	74500	Miscellaneous	2,000	2,000	2,000	2,000	2,000	10,000	h	
	Total GEF Project Management					30,000	28,000	28,000	28,000	28,000	142,000	
	4000	UNDP	72100	Contractual Services - Companies	20,000	20,000	20,000	20,000	20,000	100,000	ii	
	4000	UNDP	71400	Contractual Services - Individuals	20,000	20,000	20,000	20,000	20,000	100,000	ii	
	Total UNDP Project Management					40,000	40,000	40,000	40,000	40,000	200,000	
	Total Project Management					70,000	68,000	68,000	68,000	68,000	342,000	
Total GEF					582,000	657,000	683,000	648,000	617,669	3,187,669		
Total UNDP					80,000	80,000	80,000	80,000	80,000	400,000		
TOTAL Project					662,000	737,000	763,000	728,000	697,669	3,587,669		

Budget Notes

- a International expert (RE-based mini-grids) will, with assistance of local consultants, design the policy instruments
- b Local consultant will be hired to support the design of policy instruments
- c International/domestic travel to project sites
- d Equipment costs cover promotion documents and equipments
- e Investment on the OBA scheme. It is a grant that will follow UNDP Micro grants policies and procedures⁵¹.
- f Printing and reproduction of legal and technical documentation
- g Training, workshop, meetings related to policy design, enact and enforcement
- h Miscellaneous expenses

⁵¹ The OBA will follow UNDP Micro grants policies and procedures, and in term of procurement as well. It would be like procuring upfront a certain quantity of electricity in bulk (xx kWh @ a certain subsidized price of yy \$ per kWh, to be paid upon delivery). The mini-grid operators will be selected competitively and that the required subsidy will be a selection criteria; it would be like a reverse auction with price recovery: companies are invited to bid for the installation and operation of the mini grids and they would need to indicate how much subsidy would be required to achieve viability. A thorough study on how it will operate is expected at early stages of project implementation.

- i Companies hired to support policy design, enact and enforcement
- j Individuals hired to support policy design, enact and enforcement
- k International expert (RE-based mini-grids) hired for technology and services supply chain
- l Local consultant will be hired to support the technology and services supply chain
- m International/domestic travel to project sites
- n Companies hired to support the technology and services supply chain
- o Training, workshop, meetings related to technology and services supply chain
- p Equipment costs cover promotion documents and equipments
- q International consultant will provide technical advice
- r Local consultant will be hired to support international consultant
- s International/domestic travel to project sites
- t Equipment costs cover promotion documents and equipments
- u Training, workshop, meetings related to MHP-based mini-grids investments
- v Companies hired to support the MHP-based mini-grids investments
- w International consultant will provide Public Relations and promoting investment advice
- x Local consultant will be hired to support international consultant
- y International/domestic travel to project sites
- z Equipment costs cover promotion documents and equipments
- aa Training, workshop, meetings related to Public Relations and promoting investment advice
- bb Companies hired to support Public Relations and promoting investment
- cc Individuals hired to support Public Relations and promoting investment
- dd Project Personnel/management related cost.
- ee International/domestic travel to project sites
- ff Equipment and furniture for Project Management Unit
- gg Project annual audit
- hh Others projects costs, related to Direct Project Costs (DPCs), described in Annex 7.
- ii Project Personnel/management related cost.

Summary of funds

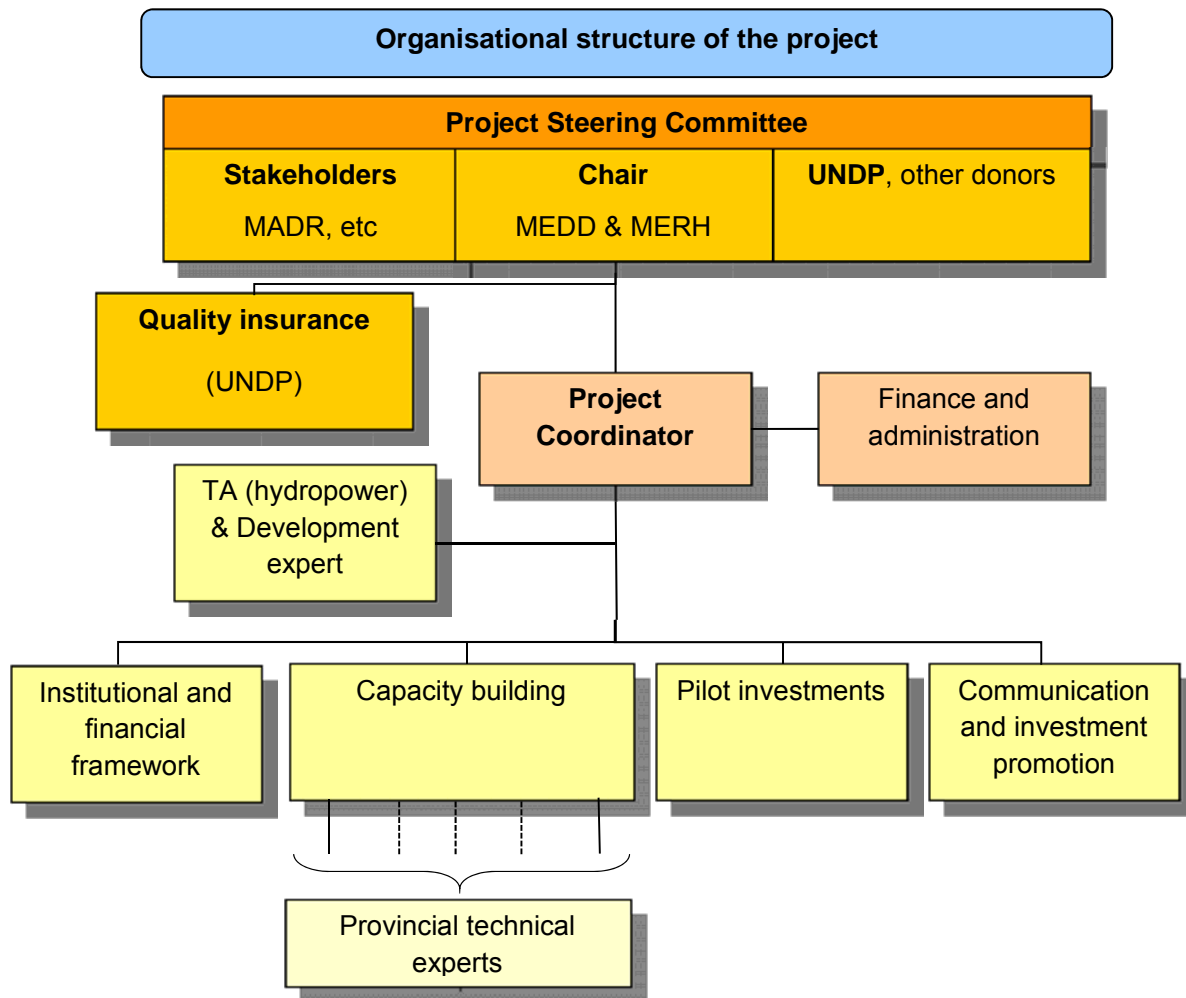
Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount (USD)
National Government	Ministry of Energy and Hydraulic Resources	Cash	13,000,000
GEF Agency	UNDP	Cash	400,000
GEF Agency	UNDP (through Gov of South Korea and Netherlands)	Cash	750,000
Total of co-financing			14,150,000

5. Management arrangements

The project will be managed by an organizational structure described in the diagram below. The project will be implemented by the MEDD, MERH and UNDP, with other responsible organizations (including the ministries related to agriculture, finance, industry), and in close consultation with other stakeholders.

The project will be implemented according to the guidelines of the UNDP projects executed nationwide. The project meets the objectives of the UNDAF framework, and as such, the responsibility of the execution returns to the Government.

Graph 4: Organisation of the management of the project



The project is overseen by a Project Steering Committee (PSC), which provides strategic direction and approves the annual budget of the project. The Steering Committee also examines the various project activities, through activities provided by the Project Management Unit (PMU) reports. The Steering Committee is the organ of key project decision. It is chaired by the MEDD and HRE, and consists of representatives of UNDP, provincial governments, the private sector and other donors contributing to the financing of the project.

The project will be managed by an organizational structure described in the diagram below. The project will be implemented by the MEDD, MERH and UNDP, with other responsible organizations (including the ministries related to agriculture, finance, industry), and in close consultation with other stakeholders.

The project will be implemented according to the guidelines of the UNDP projects executed nationwide. The project meets the objectives of the UNDAF framework, and as such, the responsibility of the execution returns to the Government.

The executing agency of the project will recruit a Project Manager. The Project Manager will have the following tasks:

- Coordinate project activities with activities of other government bodies;
- Supervise project expenditures in accordance with the work plans and approved by the Steering Committee budgets;
- Assist, monitor and report on the markets and the implementation of activities within the deadlines set by the PTA;
- Accept the terms of reference for consultants and tendering documents for the inputs resulting in a subcontracting
- Make reports to UNDP on the implementation and impacts of the project.

The PSC will make management decisions consensus when the Project Manager will seek his advice. It reviews and approves quarterly work plans where required, based on the Annual Work Plans (AWP) approved in advance. He must give his permission for any major modification work plans quarterly or annual. In addition, it approves the appointment and defining the responsibilities of the Project Manager and any delegation of responsibilities to the Project Manager in terms of quality and assurance.

The PSC will meet quarterly. Other stakeholders may be invited to meetings on time if circumstances require. However, the PSC will remain small enough to be fully operational. The final list of members of the PSC will be completed at the start of project activities, and presented in the Inception Report. The Inception Report will include the roles envisaged for different members of the PSC. The Project Manager will attend meetings of the CPP as a non-voting member, and will be responsible for writing a summary of the discussions and conclusions of each of these meetings.

The daily management of the project is provided by the PMU, under the overall leadership of the PSC, and in the daily conduct of the Project Manager. The PMU is based in Kinshasa, and reports to the UNDP, the executing agency and the PSC. In addition to the Project Manager, the PMU will consist of a project assistant and an accountant. The Project Manager will be appointed jointly by the executing agency and UNDP.

The specific project needs for these different positions are detailed in the draft terms of reference corresponding presented in the appendix of this document.

The estimated budget of the project integrates fully operational costs related to the PMU and the PSC, as well as travel required of the project team on the ground. This will ensure the effectiveness of project management in respect of funds allocated by the GEF and other donors. The Project Manager will be assisted on a case of international expert in hydro, and national experts who will lead the implementation of specific technical support of the project components.

Contacts should be established with experts and institutions of other countries that have already implemented similar projects to promote hydropower and with useful experience.

UNDP CO will support the monitoring and overall management of the project budget. He will be responsible for monitoring the implementation of the project, the submission of reports within the required timeframe, the Regional Coordination Unit of UNDP and GEF, and organization journals and mandatory evaluations (and possibly further, if necessary) of the project. It will assist the implementing agency by providing expert services and other project inputs it needs, and administering the various contracts. In addition, UNDP will contribute to the coordination and linking with other initiatives and institutions related to the project in the country.

In order to achieve the objectives and expected outcomes for the project, it is essential to closely monitor the progress of various project components. This monitoring must be done by both stakeholders and local authorities and by international advisers of the project. First, they contribute to the finalization of work plans for each project component and the provisions of the project. They will then follow the project implementation phase. Facilitate the identification of potential risks violating the successful completion of this project organization aims. This will be implemented, if necessary adaptive management of the project early corrective actions to the risks encountered.

In order to give proper recognition to the GEF for funding it provides, the GEF logo will appear on all publications of the GEF project involved, and the equipment purchased with GEF funds. Quotations related to other GEF projects in the publications of the project should also be appropriate mention of the GEF.

6. Monitoring framework, evaluation, reporting and auditing

The project will be monitored through the following M&E activities. The M&E budget is provided in the table below.

Project start:

A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

- a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- b) Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of value chain actors are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in ATLAS, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (1 July to 30 June). The APR/PIR combines both UNDP and GEF reporting requirements.

The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:

UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:

The project will undergo an independent Mid-Term Review at the mid-point of project implementation (30 months after the project start). The Mid-Term Review will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the Mid-Term Review will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-Term Review will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The relevant GEF Focal Area Tracking Tools will also be completed during the Mid-Term Review cycle.

End of Project:

An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the Mid-Term Review, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:

Results from the project will be disseminated within and beyond the project intervention zone 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 project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Audit Clause:

Audit will be conducted according to UNDP Financial Regulations and Rules and applicable Audit policies.

Table M&E costs

Type of M&E activity	Responsible Parties	Budget in USD <i>Excluding project team Staff time</i>	Time frame
Inception Workshop	<ul style="list-style-type: none">Project ManagerUNDP COUNDP GEF	15,000 USD	Within first two months of project start up
Inception Report	<ul style="list-style-type: none">Project Management UnitUNDP CO	None	Immediately following Inception Workshop
Measurement of Means of Verification for Project Purpose Indicators	<ul style="list-style-type: none">Project Coordinator will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members	To be finalized in Inception Phase and Workshop. Indicative cost 75,000 USD	Start, mid and end of project
Measurement of Means of Verification for Project Progress and Performance	<ul style="list-style-type: none">Oversight by Project GEF Technical Advisor and Project Coordinator	To be determined as part of the Annual Work Plan's preparation.	Annually prior to APR/PIR and to the

(measured on an annual basis)	<ul style="list-style-type: none"> ▪ Measurements by regional field officers and local IAs 		definition of annual work plans
APR and PIR	<ul style="list-style-type: none"> ▪ Project Team ▪ UNDP-CO ▪ UNDP-GEF 	None	Annually
TPR and TPR report	<ul style="list-style-type: none"> ▪ Government Counterparts ▪ UNDP CO ▪ Project team ▪ UNDP-GEF Regional Coordinating Unit 	None	Every year, upon receipt of APR
Steering Committee Meetings	<ul style="list-style-type: none"> ▪ Project Coordinator ▪ UNDP CO 	None	Following Project Inception and subsequently at least once a year
Periodic status reports	<ul style="list-style-type: none"> ▪ Project team 	5,000 USD	To be determined by Project team and UNDP CO
Technical reports	<ul style="list-style-type: none"> ▪ Project team ▪ Hired consultants as needed 	15,000 USD	To be determined by Project Team and UNDP-CO
Mid-term External Evaluation	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP- CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 	30,000 USD	At the mid-point of project implementation.
Final External Evaluation	<ul style="list-style-type: none"> ▪ Project team, ▪ UNDP-CO ▪ UNDP-GEF Regional Coordinating Unit ▪ External Consultants (i.e. evaluation team) 	40,000 USD	At the end of project implementation
Terminal Report	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP-CO ▪ External Consultant 	None	At least one month before the end of the project
Lessons learned	<ul style="list-style-type: none"> ▪ Project team ▪ UNDP-GEF Regional Coordinating Unit (suggested formats for documenting best practices, etc) 	16,000 USD (average 4,000 per year)	Yearly
Audit	<ul style="list-style-type: none"> ▪ UNDP-CO ▪ Project team 	Indicative cost per year: \$ 3,000 (Total: \$ 15,000)	Yearly
Visits to field sites (UNDP staff travel costs to be charged to IA fees)	<ul style="list-style-type: none"> ▪ UNDP Country Office ▪ UNDP-GEF Regional Coordinating Unit (as appropriate) ▪ Government representatives 	None	Yearly
Total indicative cost <i>Excluding project team staff time and UNDP staff and travel expenses</i>		211,000 USD	

7. Legal context

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the Standard Basic Assistance Agreement (SBAA) and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- 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;
- assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to 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/GEF 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.

The UNDP Resident Representative in DRC is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP Regional Coordination Unit and is assured that the other signatories to the Project Document have no objection to the proposed changes:

- Revision of, or addition to, any of the annexes to the Project Document;
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- Inclusion of additional annexes and attachments only as set out here in this Project Document

Standard text has been inserted in the template. It should be noted that although there is no specific statement on the responsibility for the safety and security of the executing agency in the SBAA and the supplemental provisions, the second paragraph of the inserted text should read in line with the statement as specified in SBAA and the supplemental provision, i.e. "the Parties may agree that an Executing Agency shall assume primary responsibility for execution of a project."

If the country has signed the *Standard Basic Assistance Agreement (SBAA)*, the following standard text must be quoted:

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner. The implementing partner 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 the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to 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.

If the country has not signed the SBAA, the following standard text must be quoted: "This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together the instrument envisaged in the Supplemental Provisions to the Project Document, attached hereto.

Consistent with the above Supplemental Provisions, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner. The implementing partner 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 the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to 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.”

The following standard text for a global/ multi country and regional projects should be included: “This project forms part of an overall programmatic framework under which several separate associated country level activities will be implemented. When assistance and support services are provided from this Project to the associated country level activities, this document shall be the “Project Document” instrument referred to in: (i) the respective signed SBAA’s for the specific countries; or (ii) in the Supplemental Provisions attached to the Project Document in cases where the recipient country has not signed an SBAA with UNDP, attached hereto and forming an integral part hereof.

This project will be implemented by the agency (name of agency) (“Implementing Partner”) in accordance with its financial regulations, rules, practices and procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. Where the financial governance of an Implementing Partner does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition, the financial governance of UNDP shall apply.

The responsibility for the safety and security of the Implementing Partner and its personnel and property, and of UNDP’s property in the Implementing Partner’s custody, rests with the Implementing Partner. The Implementing Partner 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 the Implementing Partner’s security, and the full implementation of the security plan. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The Implementing Partner agrees to 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.”

8. Annex 1: Risks analysis

Project title:	Award ID:	Date:
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Risks	Description	Probability of occurrence	Impact	Mitigation
In all project phases				
Security	Persistent general insecurity in some provinces	Medium to high	Impossibility to complete the project	<ul style="list-style-type: none"> - Regular assessment of the security situation with the help of United Nations agencies and the government; - Developing partnerships with renowned local NGOs in areas with security risks; - Install pilot installations in high security areas.
Governance	Possibility that funds allocated to the project are not used, due to the lack of culture of transparency within the PMU	Medium	Decommissioning of project funds leading to incomplete implementation of the various phases of the project.	Appointment of a Steering Committee composed of representatives of key government institutions (MERH, MEDD, Ministry of Finance) regularly evaluating the expenses incurred by the PMU, the procedures underway for specific activities, and regularly auditing the financial and activity reports.
Site accessibility	Access roads to the site in poor conditions	Medium	Delays in site visit, on-site construction and training activities	<ul style="list-style-type: none"> - Good planning necessary for on-site activities, integrating the many uncertainties ; - Choice of sites accessible from major centers by road, boat or train.
Studies Phase				
Opportunity	Slowness and bureaucracy red tapes during the study launch process	Medium	Delay in implementing the various phases of feasibility studies	Close supervision of the execution of the steps for the appointment of consultants and strengthening the PMU to avoid the bureaucracy
Power Plants Planning Phase				
Financial	Delay in the availability of government and project partners fundings	Medium	Delay in payments causing delays in the construction of power plants	Detailed financial plan approved during the study phase, and medium and long term timetables designed with disbursement dates agreed.
Site configuration	Changes in the site configuration (soils, etc.) caused by human activity and potential landslides	Low	Substantial changes in the construction phase and its cost	Site selection and feasibility studies should take into account all these details
Delay in construction	The recruitment procedure for a contractor is slow	Medium	Delay in the commissioning of the MHPP	<p>Detailed plans and deadlines are set during the tendering process ;</p> <p>Penalties will be applied when a contractor is found off budget or if there is a late delivery of the MHPP;</p> <p>The goods to be imported shall be granted an exempting tax system.</p>
Goods and services	Increase in the market price of materials and equipment	Low	Change in the design and plans of the MHPP	Detailed and well-managed procurement process that provides goods and services from sources with a very good reputation
Operation and maintenance phase				
Improper billing	Billing not remunerative	Medium	Frequent power cuts due to the impossibility to recover enough fees to take in	- Site selection should be based on the ability of beneficiaries to pay their electric energy consumption bills ;

			<i>charge fixed costs or to renew the production equipment and spare parts</i>	<ul style="list-style-type: none"> - <i>Involvement of community organizations and local councils in the early stages and construction phase;</i> - <i>The project will define an operational plan for five years after the commissioning of the plant.</i>
<i>Inadequate maintenance</i>	<i>The MHPP operate intermittently and without proper maintenance after commissioning</i>	<i>Medium</i>	<i>Unwanted power cuts and unballastings</i>	<ul style="list-style-type: none"> - <i>Appropriate training and involvement of local communities, with a training if possible in local languages;</i> - <i>Development of training materials in local language;</i> - <i>Development and delivery of maintenance kits on-site.</i>
<i>Financial</i>	<i>Low income of populations that causes a low ability to pay for electric energy bills</i>	<i>Medium to high</i>	<i>Project sustainability affected</i>	<ul style="list-style-type: none"> - <i>Elaboration of a results-based aid scheme ;</i> - <i>Establishment of a committee which will be the single distribution point of the service provider, and that will handle subscribers by covering the bills either in cash or in kind;</i> - <i>Installation of prepayment meters which will have the advantage of ensuring the rational management of energy</i>
<i>Overall</i>		<i>Medium to high</i>		<i>- Several specific risks have been identified, with results in the overall range of a medium to high risks project</i>

9. Annex 2: Draft Terms of reference of key project personal – Project Manager / Administrative Officer

A. Project Manager (PM)

B. Administrative and Financial Officer

A. Project Manager (PM)

Functions and responsibilities

The PM will work under the direct supervision of the National Project Director (NPD) of the MRHE and under the technical supervision of the environment thematic leader of the UNDP. He/She will be responsible for working closely with the extended project team. He/she will particularly:

- Assist the NPD for the general project management, particularly the program's resources mobilization, the personnel, consultants and subcontractors' supervision;
- Assist the NPD for the realization and supervision of the project's products;
- Ensure the setting up of and the attainment of the objective and of all the expected outcomes and outputs of the UNDP/GEF project with the cooperation of all stakeholders;
- Prepare all periodic reports required by the UNDP/GEF, including technical and financial quarterly reports;
- Coordinate the recruitment and selection of the project's personnel with the NPD and the project's partners;
- Disseminate the program's reports and respond to interested stakeholders' questions;
- Supervise the sharing and exchange of good practices and lessons learnt with relevant programs of marine and coastal biodiversity conservation and integrated development on a community basis at the national and international levels;
- Coordinate and help scientific institutions, technical teams and consultants to start and set up all studies and monitoring components of the project;
- Assist and advise communication teams (preparation of documentaries, TV ads, guides and sensitization campaigns, field studies, etc.)

Recruitment criteria

The activity's undertaking will be apportioned to a high level national expert presenting the following qualifications:

- Have at least an university postgraduate degree (Masters degree) or an equivalent in renewables engineering, specialization in hydroelectricity or any similar subject;
- Have at least seven (7) years of experience in renewables, particularly in hydroelectricity;
- Have at least four (4) years of experience in programs/projects' management or at a leadership position (director, department head, etc.);
- Good multidisciplinary and multicultural team management skills;
- Good oral and written communication skills in French; knowledge of English is a strong asset;
- Knowledge of Lingala and national languages is a plus;
- Previous working experience with national institutions, UNDP, United Nation's system agencies or international organizations/institutions is a plus;
- Have excellent computer skills, particularly proficiency with classical IT tools and applications.

B. Administrative and Financial Officer (AFO)

Functions and responsibilities

The AFO will work under the direct supervision of the National Project Director (NPD) of the MRHE and of the Project Manager (PM).

He/She will be responsible for the entire project's administrative (human resources, organization and logistics) and financial (expenses, accounts management, treasury management) aspects. He/she will be responsible for the daily management, the preparation of implementation reports, the follow-up with local organizations and the required follow-up and assessment of the project management team.

- Assist the NPD for the general project management, particularly the program's resources mobilization, the personnel, consultants and subcontractors' supervision;
- Provide logistics support to the NPD, PM and consultants upon the entire project's activities (training, workshops, stakeholders' consultation, field trips, etc.);
- During the international experts' visit, take care of visas, transportation and accommodation (hotels, etc.) issues;
- Manage the budgeted expenses by preparing payment documents and financial reports;
- Keep the project's expenses book;
- Manage the archiving: keep the records, the files containing the project documents, the experts' reports, etc.;
- Control the sustainable use of materials (bookkeeping, regular inventories);
- Maintain a regular contact between experts and project's consultants so as to keep them informed upon project's details and possible modifications;
- Take care of translation to English whenever/wherever necessary;
- Prepare drafts for correspondence and administrative documents;
- Take care of business trips;
- Take care of phone requests, fax, postal and electronic communications, and coordinate meetings;
- Execute every administrative or financial obligation required by the PM;
- Organize and coordinate the project's services and supplies' procurement process

Recruitment criteria

The activity's undertaking will be apportioned to a high level national expert presenting the following qualifications:

- Have at least an university postgraduate degree or business degree (Masters degree) or MBA in Social Sciences or any other relevant subject with an excellent understanding of financial management;
- Have at least five (5) years of experience in office administration, preferably in relation to United Nations' projects;
- Previous working experience with national institutions, UNDP, United Nation's system agencies or international organizations/institutions is a plus;
- Good oral and written communication skills in French; knowledge of English is a strong asset;
- Knowledge of Lingala and national languages is a plus;
- Have excellent relationship and redaction skills;
- Have excellent computer skills, particularly proficiency with classical IT tools and applications.

10. Annex 3: Identified pilot sites

Conventional hydropower is a classification of micro, mini and pico-hydro power plants according to the following:

CLASSIFICATION ACCORDING TO POWER PLANTS

Types of centrals	Power
Picocentrale hydroélectric	Power less than 20 kW.
Microcentrale hydroélectric	Power less than 500 kW.
Mini centrale hydroélectric	Power less than 2 MW.

Source: <http://centrale-hydroelectrique.comprendrechoisir.com/comprendre/micro-centrale-hydroelectrique>

Since it is desired not to exceed a total of 1MW per province as a power in the proposal to develop this project, the technology proposals will be the type, pico, micro and mini hydroelectric power station.

Province or Territory	Sites	District	River	Flow (m3/sec)	Drop height (m)	Estimated Power (kW)	Center to be electrified	Pop.	Number of households	Distance from the center to be electrified (km)	Cost (US \$ 103)
Kinshasa	Mbankana	Maluku	Lufimi	3.1(min)	4.50	100-300	NGO CADIM at Mbankana city	15200	2171	1	250-750
TOTAL POWER FOR KINSHASA PERIPHERY (kw)						300	TOTAL INVESTMENT COST			750	
Bandundu	Mwanzi	Bagata	Mwanzi	2,8	7	196	Fatundu Wamba	4000	500	8	588
	Mukulu	Gungu	Makulu	5.3	6	315	Mundundu	3850	480	1,5	945
	Munganzaa	Kutu	Munganzaa	6	3,3	200	Mongobele Bondjon	4000	500	0,7	600
	Loano	Bulungu	Loano	3,5	7	236	Kipuka	1819	364	6	708
TOTAL POWER FOR BANDUNDU (kW)						947	TOTAL INVESTMENT COST			2841	
Bas Congo	Nsangi	Madimba	Mfidi	4,7	8	376	Ngidinga	15000	1875	5	1128
	Nianza	Cataractes	Yangi	1.0	24	200	Luozi				600
	Lunionzo	Songololo	Lunionzo	4	3	100	Nsona-Mpangu	3690	461	3	300
	Kikozo	Tshela	Lubuzi	8	7	194	Kizu	6150	769	6	582
	Kintadi	Kasangulu	N'djili	270	1	265	Kimpundi	2000	250	4	795
TOTAL POWER FOR BAS-CONGO (kW)						1135	TOTAL INVESTMENT COST			3405	
Equateur	Wuwu	Bosobolo	Wuwu	17	3	400	Bili	1980	247	0,6	1200
	Molua	Bumba	Molua	9	2	200	Bandela	1160	158	0,5	600
	Mole	Businga	Mole	7	5	350	Mondjo	1000	130	1	1050
TOTAL POWER FOR EQUATEUR (kW)						950	TOTAL INVESTMENT COST			2850	
Province Orientale	Tsé	Djugu	Tsé	1,8	38	420	Batsi	3200	400	1,8	1260
	Lyenge	Opala	Lyenge	3	4	122	Yatoko	1130	150	0,8	366

Province or Territory	Sites	District	River	Flow	Drop height (m)	Estimated Power (kW)	Center to be electrified	Pop.	Number of households	Distance from the center to be electrified (km)	Cost (US \$ 103)
	Bale	Buta	Bale 2	11	3,5	400	Bondongbale	1300	162	0,5	1200
	Yame	Banalia	Yame	0,7	3,5	132	Bagbugbuzi	1206	150	2	396
TOTAL POWER FOR the ORIENTALE PROVINCE (kW)						1074	TOTAL INVESTMENT COST				3222
Nord-Kivu	Chochota	Béni	Mamundioma	1,8	8	500	Oicha Mbau	2000	250	7	435
	Kivirikuku	Lubero	Kivirikuku	10	5	500	Kitumbiro	1000	130	5	1500
	Nkanga	Rutshuru	Rutshuru	1,4	8	112	Jomba	2000	133		336
TOTAL POWER FOR NORD-KIVU (kW)						1112	TOTAL INVESTMENT COST				2271
Sud-Kivu	Sangano	Kalehe	Sangano	-	-	40	Kalehe		120		120
	Mushuva	Kabare	Mushuva	-	-	50	Bushumba		300		150
	Cizimololo	Kabare	Cizimololo	-	-	50	Mudaka		350		150
	Luiro/Formulac	Kabare	Luiro/Formulac	-	-	175	Katana		150		525
	Lubumba	Uvira	Lubumba	4	12	500	Ndolera	8000	980	0,4	1500
TOTAL POWER FOR SOUTH-KIVU (kW)						815	TOTAL INVESTMENT COST				2445
Maniema	Munumi	Kabambare	Bulungula	0,2	68	153	Kayembe (Wamaza Centre)	4000	500	5	459
	Agogo	Kabambare	Lwika	5,2	8	421	Pena Katempa	1500	200	3	1263
	Kailo	Pangi	Tshala	5	5,5	237	Lokando Cité	3600	450	1	711
TOTAL POWER FOR MANIEMA (kW)						811	TOTAL INVESTMENT COST				2433
Katanga	Lukombe	Kalemie	Kijija	2,5	3	174	Lukombe	1019	188	3	609
	Ilunga	Kongolo	Kihombo	2,5	3	160	Ilunga	1884	245	0,8	560
	Musokatanda	Mutshatsha	Tshibundji	1,4	12	165	Musokatanda	1625	203	3	577,5
	Lububu	Kabongo	Lububu	1,2	7	147	Lububu	500	65	1,2	514

Province or Territory	Sites	District	River	Flow	Drop height (m)	Estimated Power (kW)	Center to be electrified	Pop.	Number of households	Distance from the center to be electrified (km)	Cost (US \$ 103)
	Lukushi	Manono	Lukushi	4	3	118	Lukushi	1500	187	6	413
TOTAL POWER FOR KATANGA (kW)						764	TOTAL INVESTMENT COST				2673,5
Kasai Occidental	Mutefu	Kazumba	Miao	10	5	500	Mutefu/Bilomba	3000	390	3 à 9	1500
	Kaluebo	Luebo	Kaluebo	9	3	268	Kaluebo	2500	320	5	804
	Kajangayi	Dibaya	Moyo	4	8	319	Kajangayi	600	150	3	957
TOTAL POWER FOR KASAI OCCIDENTAL (kW)						1087	TOTAL INVESTMENT COST				3261
Kasai Oriental	Lukelenge	Muya Commune (Mbuji Mayi)	Lukelenge	-	-	400	Muya Commune in Mbuji-Mayi	720000	120000	5	1200
	Ludimbi	Kabinda District , Territory of Kabinda	Ludimbi	-	-	242	Kabinda	79.928	11418	1	726
	Lomami	Sankuru District , the Territory of Katako-Kombe	Kalelu	-	-	392	Katako Kombe	13.693	1956	1	1176
TOTAL POWER FOR KASAI ORIENTAL (kW)						1034	TOTAL INVESTMENT COST				3102
TOTAL POWER FOR THE MHPP PILOTE PROJETS (kW)						10029	TOTAL INVESTMENT COST				29253,5

For a total installed capacity of 10.029 MW, an investment cost (stand) of 29,253,500 USD is required

11. Annex 4: Description of UNDP Country Office support services

Reference is made to consultations between [*insert name of Designated institution*], the institution designated by the Government of DRC and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project “Promotion of micro-hydropower in the country”, “the Project”.

In accordance with the provisions of the letter of agreement signed on [*insert date of agreement*] and the project document, the UNDP country office shall provide support services for the Project as described below.

Support services to be provided:

Support services (insert description)	Schedule for the provision of the support services	Cost to UNDP of providing such support services (where appropriate)	Amount and method of reimbursement of UNDP (where appropriate)
1. Financial transactions	Processing payment related to the project activities	[insert amount]	[insert amount]
2. Procurement	Consultancy services Equipment and materials Travel related services	[insert amount]	[insert amount]
3. HR services	Identification and recruitment of project personnel Management of staff contracts	[insert amount]	[insert amount]

Description of functions and responsibilities of the parties involved, as per National Implementation Modality (NIM) guidelines and UNDP financial regulations.

MERH:

- Submission of letter requesting for the procurement of good and services
- Submission of original invoice, signed vendor forms and other supporting documentation for processing Requests for Direct Payment
- Certification of approval of payments to consultants via e-mail by Project Director

UNDP:

- Processing of payments as per submitted by IP
- Procurement of goods and services as per requested by IP
- HR management of project and programme staff support

12. Annex 5: Content of the Technical trainings Programs (for activities 12.5.1 and 12.5.2)

Content of Professional Training Program

Objectives: At the end of the course, learners will be able to monitor the operation of at least one component of MHPP, ensuring all operations command and control, to ensure maintenance of works civil engineering and electromechanical equipment.

N°	Module for the Cours	Module content	Timing
1	A descriptive study of the elements of a small hydroelectric plant	The dam, water intake, the fishway, brought from the channel, the sand trap, the loading chamber, penstock, the plant (the plant), the leakage or return channel.	1 month
2	Electromechanical equipment of MHPP	The inlet valve, turbine, generator, organs of control and control of the system, processor, the protection and connection facilities to the power grid	1 month
3	Hydraulic turbines manufacturing techniques	Different types of hydraulic turbines, hydraulic turbines Manufacture	1 month
4	Facilities for maneuver and auxiliary in MHPP	Various valves, control equipment, auxiliaries, etc.	1 month
5	Maintenance of MHPP	Maintenance concepts, different maintenance procedures applied to components of a MHPP.	1 month
6	Power grid	Transmission system and distribution network, network protection, metering and electricity pricing	1 month
7	Installing of a MHPP	Case study existing or new cases	

12.5.2. Training Program content for the University level

Objectives: At the end of the training, which will last for one academic year, students will have the control of different stages of a project of MHPP: design, site selection, feasibility studies, financial analysis, Management, Assessment impacts, etc. One condition for admission to the program will be at least a university undergraduate degree.

Nº	Title	Module content
1	Introduction	<ul style="list-style-type: none"> - Primary energy sources, instead of hydropower - Power plants, instead of the small central HPP - Configurations MHPP sites - Steps Project MHPP (administrative, technical steps: preliminary studies)
2	Choice and assessment of the site	<ul style="list-style-type: none"> - Mapping - Tools of the Geographic Information System - Geotechnical studies - Evaluation of the application and potential of hydropower - Failure analysis
3	Hydrology for hydroelectricity	<ul style="list-style-type: none"> - Hydraulic Principles (flow in pipes and canals) - Flow measurement - Characteristics of stream flows - Curves flow duration (Statistics applied to hydrology) - floods
4	Design of MHPP	<ol style="list-style-type: none"> 1. Civil Engineering Works <ul style="list-style-type: none"> - Dams - Weirs and spillways - Settling ponds - Valves - Open channels - The penstocks - The leakage channels 2. The electromechanical equipment <ul style="list-style-type: none"> - Hydraulic turbines

		<ul style="list-style-type: none"> - Speed Multipliers - Generators
5	Maintenance of MHPP	<ul style="list-style-type: none"> - Maintenance of industrial systems Notions - Maintenance of civil engineering works - Maintenance of electromechanical equipment
6	Economical Analysis of MHPP Projects	<ul style="list-style-type: none"> - Basic Considerations - Principles discount monetary values - Economic Evaluation Methods
7	Assessment of the environmental and societal impact	<ul style="list-style-type: none"> Identification of financial burdens and impacts - Impacts during construction phase - Impacts generated by the operation of the MHPP - Impacts of power lines
8	IT tools to support the decision	<ul style="list-style-type: none"> - Using RETScreen - Other software tools
9	Case Studies Analysis	Typical examples

13. Annex 6: Results of the financial sustainability of the MHPP based on the RETScreen software analysis.

Financial viability					
Themes			Sites		
			MAHANO Nord-KIVU	CHIBAYI Sud-Kivu	Lulua/ Kasai – Occ.
Financial parameters					
	Inflation rate	%	12,0%	12,0%	1,5%
	Project lifetime	an	40	30	40
	Debt ratio	%	70%	70%	0,0
	Interest rate (debt)	%	5,00%	10,00%	
	Loan period	an	30	10	
Investment costs					
	Power production equipments	\$	377 781	574 887	550.000
	Others	\$	37 778		
	Total – investment costs	\$	415 559	574 887	550.000
Subsidises and grants					
Operation costs and financial costs					
	OMM costs	\$			
	Cost of energy	\$	0	0	
	Financial cost (debt reimbursement) – 10 years			65 492	
	Financial cost (debt reimbursement) – 30 years	\$	18 923		
	Total - Operation costs and financial costs	\$	18 923	65 492	
Yearly incomes					
	Cost of energy	\$	0	0	
	Incomes (electricity)	\$	11 415	97 446	
		\$			
	Total incomes	\$	11 415	97 446	80.000
Financial viability					
	IRR before taxes – assets	%	16,0%	47,5%	16,2%
	IRR before taxes	%	10,7%	25,0%	
	Yearly rreturn	an	36,4	5,9	6,9
	Return on assets	an	13,3	3,0	6,5

Energetic model an hydrologic assessment

Software results to analyze clean energy projects		Power production for the case study		
Project name	MHPP MBANKANA	Evaluation of the resources		
Site of the project	MBANAKANA	Proposed projects		Run of the river
Prepared by	MERH - MEDD	Hydrological anamysis method	Specific flow	
Prepared by	Prof. Jacques ZAHIGA	Waterfall high	m	4,5
Type of project	Power production	Maximal effect of the water flow	m	0,00
Technology	Hysropower turbine	Evaluation method of the water flow	Defined by the user	
Network type	Off grid	Average water stream	m ³ /s	30,0
Type of analysis	Method 2	Residual stream	m ³ /s	20,000

Unit	USD	% of the available stream	%	100,0%
Units	Metric unit	Hydropower turbines		
Place of the meteorological data	Kenge	Nominal equipment stream	m³/s	3,1
		Type		Turbine
		Turbine efficiency		Standard
Symbol	USD	Number of turbines		2
Units	Metric unit	Provider	ABC Ltée	
Latitude (°N)	-4,8	Model	Tbd	
Longitude (°E)	16,9	Conception coefficient		4,5
Élevation (m)	560	Efficiency adjustment	%	0,0%
Outside temperature for heating measurement (°C)	19,0	Optimal efficiency of the turbine	%	83,4%
Outside temperature for cooling measurement (°C)	32,7	Optimal efficiency of the turbine	m³/s	3,1
Amplitude in ground temperature (°C)	14,5	Turbine efficiency at the optimal stream	%	83,4%

Investment costs analysis

Investment costs	Unit	Quantity	Unit cost (USD)	Amount (USD)	Cost share	%	Amout
Feasibility study							
Site inspection	j-p			3.000			
Évaluation of the resources	projet	5	500	2.500			
Environmental evaluation	j-p	10	500	5.000			
Preliminary conception	j-p	20	500	10.000			
Detailed estimation of the costs	j-p	5	600	3.000			
Baseline scenari	project	0		-			
Report preparation	j-p	5	700	3.500			
Project management	j-p	10	700	7.000			USD -
Travel and accomodation	travel-p	2	3.000	6.000			
Defined by user	Coût	0		-			
		0		USD -			
Sub-total :				40.000	6,8%	0%	
Development							
Negotiation of contracts	j-p	0	1.000	-			
Permits and approvals	j-p	0	700	-			
Land use rights	j-p	5	500	2.500			
Validation and registration related to GHG	projet	0		-			
Project financing	j-p	3	1.000	2.500			
Accounting and legal aspects	j-p	5	1.000	5.000			
Project management	j-p	0	50.000	10.000			
Travel and accomodation	travel-p	2	2.500	5.000			
Defined by users	Costs			-			
				-			
Sub-total :				25.000	4,3%	0%	
Engineering							
Conception of the site and buildings	j-p	0	80.000	8.000			
Mecanical design	j-p	3	700	1.750			
Electrical design	j-p	3	700	1.750			
Construction	j-p			-			

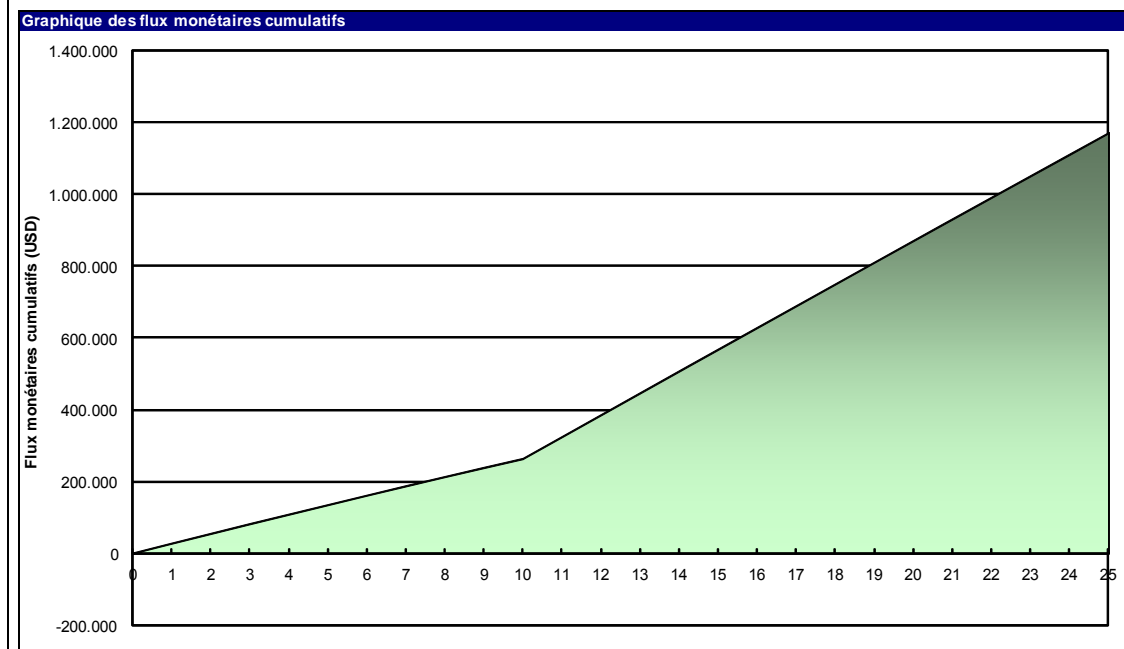
	Calls for tenders and contracts	j-p			-			
	Supervision of the work	j-p	0	80.000	8.000			
	Defined by the user	Cost			-			
	Sub-total :				19.500	3,3%	0%	
	Power generation system							
	Turbine (hydropower)	kW	98,86	2.000	197.727			
	Access path	km	1	20.000	20.000			
	Transmission line	km	2	40.000	60.000			
	Connecting point	project	0		-			
	Energy efficiency measurements	project			-			
	Deined by user	cost			-			
	Sub-total :				277.727	47,4%	0%	
	Infrastructures and others							
	Equipments for transport	projet	0	200.689	20.069			
	Equipments for préparation	projet	0	200.689	20.069			
	Equipments for storage	projet	1	8.683	8.683			
	Équipements de distribution	projet	50	40	2.000			
	Construction	m²	1	110.000	110.000			
	Security in case of goods to be changed	%	0,5%	585.242	2.926			
	Transport	project	0	190.000	15.200			
	Commissioning and training	j-p	10	700	7.000			
	Defined by user	Cost			USD -			
	Margin of error	%	5,0%	548.174	27.409			
	Interest during construction	7,00%	6 mois	575.582	10.073			
	Sub-total :				223.428	38,2%	0%	
	Total investment costs				585.655	100,0%	0%	
	Yearly costs (financial)	Units	Quantity	Unit cost	Amount		%	
	OMM							
	Lease (area and resources)	project	1		-			
	Taxes (land)	project	0	585.655	-			
	Insurance	project	0,004	585.655	2.343			
	Labor	Project	0	20.000	4.000			
	GHG monitoring	Project	0		-			
	Administrative costs	%		6.343	-			
	Defined by user	Coût			-			
	Margin of error	%	8,0%	6.343	507			
	Sub-total :				6.850		0%	

Summary (financial results)

Financial analysis RETScreen – Power generation project											
Financial parameters			Summary : costs and incomes					Yearly monetary flows			
General			Invesmten costs					An	Av. impôt	Apr. impôt	Cumulatif
Rate energy	%	3,0%	Feasibility study	6,8%	USD	40.000	#	USD	USD	USD	
Inflation rate	%	1,3%	Development	4,3%	USD	25.000	0	0	0	0	
Actualisation rate	%	7,0%	Engineering	3,3%	USD	19.500	1	32.263	27.495	27.495	
Lifetime of the project	Y	25	Power generation	47,4%	USD	277.727	2	32.188	27.289	54.784	
			Production	0,0%	USD	0	3	32.112	27.069	81.853	

Financing				Power generation	0,0%	USD	0	4	32.035	26.834	108.687
Subsidies and grants	USD	351.393		Defined by user	0,0%	USD	0	5	31.956	26.584	135.271
Ratio debt	%	40,0%		EE measures	0,0%	USD	0	6	31.876	26.316	161.587
Debt	USD	234.262		Infrastructures and others	38,2%	USD	223.428	7	31.795	26.030	187.616
Assets	USD	351.393		Total investment costs	100,0%	USD	585.655	8	31.713	25.723	213.339
Interest rate debt	%	9,00%						9	31.629	25.394	238.733
Duration loan	y	10		Grants		USD	351.393	10	31.544	25.041	263.774
Reimb debt	USD/y	36.503						11	67.961	61.165	324.939
				Annual costs and debt reimb				12	67.873	61.086	386.025
				OMM		USD	6.850	13	67.785	61.006	447.031
Analyse Income tax		<input type="checkbox"/>		Cost energy - cas proposed		USD	0	14	67.694	60.925	507.956
Income tax rate	%	10,0%		Payment debt 10 y		USD	36.503	15	67.603	60.843	568.799
Report of losses	No			Total yearly		USD	43.353	16	67.510	60.759	629.558
Method	Degrressive							17	67.416	60.674	690.232
Hald year rule	yes/no	No		Periodicity (costs)				18	67.320	60.588	750.820
Allocation cost of capital	%	0,0%				USD	0	19	67.223	60.501	811.320
Rate	%	0,0%				USD	0	20	67.124	60.412	871.732
Period	Y	15		Residual value of the prject		USD	0	21	67.024	60.322	932.054
Fiscal lag	y/n	No						22	66.923	60.230	992.284
Duration fiscal lag	year			Annual incomes and costs				23	66.819	60.137	1.052.422
				Cost of energy - baseline		USD	0	24	66.715	60.043	1.112.465
Annual incomes				Income power export		USD	0	25	66.609	59.948	1.172.413
Revenu d'exportation d'électricité				Income GHG reduction - 0 y		USD	0	26	0	0	1.172.413
Price power export	USD/MWh	0,00		Other (cost) - 25 y		USD	75.690	28	0	0	1.172.413
Indexation price expert of power	%			Totoal costs and incomes yearly		USD	75.690	30	0	0	1.172.413
Income fro GHG reduction		<input type="checkbox"/>						32	0	0	1.172.413
	tCO2/y	0						33	0	0	1.172.413
Net GHG reduction	tCO2/y	0		Financial viability				34	0	0	1.172.413
Net GHG reduction - 25y	tCO2	0		IRR before taxes - assets		%	#VAL	35	0	0	1.172.413
CO2 price	USD/tCO2			IRR before taxes		%	16,3%	36	0	0	1.172.413
Duration	y			IRR after taxes - assets		%	#VAL	38	0	0	1.172.413
Net GHG reduction -Oy	tCO2	0		IRR after taxes		%	14,3%	39	0	0	1.172.413
				Simpleret unr		y	3,4	41	0	0	1.172.413
Discount		<input type="checkbox"/>		Retunr on assets		y	0,0	42	0	0	1.172.413
% of discount on power	%	0,0%						43	0	0	1.172.413
Discount on power	USD	0		Net Present Value (NPV)		USD	467.276	44	0	0	1.172.413

Graph of cumulated monetary flows



Results Interpretation

- NPV is positive= 467.276 USD
- IRR= 14,3%>9% (cost of capital)
- Monetary flow cumulated and increasing

14. Annex 7:

STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

Dear [*name of government official*],

1. Reference is made to consultations between officials of the Government of **the Democratic Republic of Congo** (hereinafter referred to as “the Government”) and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant programme support document or project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the programme/project:

- (a) Identification and/or recruitment of project and programme personnel;
- (b) Identification and facilitation of training activities;
- (c) Procurement of goods and services;

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the programme support document or project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a programme or project, the annex to the programme support document or project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the [*Insert title and date of the UNDP standard basic assistance agreement with the Government*] (the “SBAA”), including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the programme support document or project document.
8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.
9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.
10. If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

Signed on behalf of UNDP
Moustapha Soumare
UN Resident Coordinator and
UNDP Resident Representative

For the Government
[Name/title]
[Date]

Attachment

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. Reference is made to consultations between **Ministry of Energy and Hydraulic Resources MERH** the institution designated by the Government of the Republic of Benin and officials of UNDP with respect to the provision of support services by the UNDP country office for the nationally managed project **number 00094434 on “Promotion of mini- and micro-hydropower plants in DRC”**.

2. In accordance with the provisions of the letter of agreement signed on [*insert date of agreement*] and the programme support document [*or project document*], the UNDP country office shall provide support services for the Programme [*or Project*] as described below.

3. Support services to be provided:

Support services (insert description)	Schedule for the provision of the support services	Cost to UNDP of providing such support services (where appropriate)	Amount and method of reimbursement of UNDP (where appropriate)
1.			
2.			
3.			

4. Description of functions and responsibilities of the parties involved: