REQUEST FOR CEO ENDORSEMENT/APPROVAL

PROJECT TYPE: Medium-sized Project
THE GEF TRUST FUND

SUBMISSION DATE: 30 JUNE 2011
RESUBMISSION DATE: 15 DECEMBER 2011

PART I: PROJECT INFORMATION

GEFSEC PROJECT ID: 4005
GEF AGENCY PROJECT ID: XX/IVC/09/X01
COUNTRY(IES): Cote d'ivoire
PROJECT TITLE: Promoting renewable energy based grids in rural communities for productive uses in Côte d'Ivoire
GEF AGENCY(IES): UNIDO
OTHER EXECUTING PARTNER(S): Ministry of Mines and Energy
GEF FOCAL AREA(s): Climate Change
GEF-4 STRATEGIC PROGRAM(s): SP3-Promoting Market Approaches for Renewable Energy
NAME OF PARENT PROGRAM/UMBRELLA PROJECT: GEF PROGRAMMATIC APPROACH ON ACCESS TO ENERGY IN WEST AFRICA (SPWA-CC)

Expected Calendar (mm/dd/yy)	
Milestones	**Dates**
Work Program (for FSPs only)	28 Jan 2010
Agency Approval date	Oct 2011
Implementation Start	March 2011
Project Closing Date	February 2014

A. PROJECT FRAMEWORK

Project Objective: The overall goal of the project is to develop a market-based approach for improving the access to PV based mini grids in rural areas.

Project Components	**Indicate whether Investment, TA, or STA**[2]	**Expected Outcomes**	**Expected Outputs**	**GEF Financing**[1]		**Co-Financing**[1]		**Total ($)**
				($) a	%	($) b	%	c=a+ b
1- INSTITUTIONAL, POLICY AND FINANCIAL MECHANISMS	TA	-An effective, market-oriented policy and regulatory framework to stimulate investments in RE	1.1. Strategic framework for RE energy development is prepared and ready for adoption 1.2. Institutional framework for the renewable energy sector is outlined/established identifying stakeholders, their roles and responsibilities in promoting renewable energy based mini-grids. 1.3. 3 seminar organized,, 7 policy makers trained and 5 financial institutions staff and 5 representatives of private sector trained 1.4. Model public-private partnership formulated: its structure, functioning criteria and fund flow conditions, administrative unit, etc. defined and promoted as financial mechanism, in close	17,000	36	30,000	64	47,000

			interaction with the institutional structure and stakeholders are informed of this partnership model					
2- IDENTIFICATION OF RE RESOURCES AND PREPARATION OF FEASIBILTY STUDIES	TA	A portfolio of RE energy projects prepared for pilot PPP investments during and post GEF-project	2.1. Project sites identified for the installation of viable RE systems, and prioritized following a pre-defined set of criteria promoting productive uses. 2.2 Pre-feasibility studies for 10 most promising sites are developed.	20,000	50	20,000	50	40,000
3- TECHNOLOGY DEMONSTRATION AND CREATION OF AWARENESS AND TECHNICAL CAPACITIES	TA/INV	Reduced GHG emissions and increased access to rural electrification following increased awareness and technical capabilities of stakeholders to evaluate technical and commercial viability of photovoltaic based mini grids and reduced barriers to development of businesses in renewable energies.	3.1. Feasibility studies of photovoltaic based mini grids power facilities prepared. 3. 2. Seven pilot photovoltaic based mini grids totaling 350 kW of capacity installed and operational. 3.3. In total, approx. 1750 electricity connections by 2014 of households and small local businesses. In total, approx. 8750 persons served by access to electricity. 3.4. Training of a team local authority officers and interested private sector service providers-to-be on operation, maintenance and management provided.	752,464	17	3,727,000	83	4,479,464
4- MONITORING AND EVALUATION	TA	N/A	4.1. Monitoring and evaluation plan has been implemented. 4.2. Publications on lessons learnt and toolkits have been produced and disseminated. 4. 3. Special documentaries on the pilot projects prepared and widely disseminated.	21,000	30	50,000	70	71,000
5. Project management				53,227[1]	51	50,270	49	103,497
Total Project Costs				**863,691**	**18**	**3,877,270**	**82**	**4,740,961**

[1] PM GEF funding is 6.1%. Given the nature of this project and the level of cofinancing that has been mobilized, it is clear that in addition to the Nationa Project Manager, there will be need for an administrative/finance assistant to support this project. Discussions will be held with national government with a view to get a seconded assistant from the Ministry to the project so as to reduce the PM GEF funding.

[1] List the $ by project components. The percentage is the share of GEF and Co-financing respectively of the total amount for the component.

[2] TA = Technical Assistance; STA = Scientific & Technical Analysis.

B. SOURCES OF CONFIRMED CO-FINANCING THE PROJECT (expand the table line items as necessary)

Name of Co-financier (source)	*Classification*	*Type*	*Project*	*%**
Ministry of Mines and Energy	Nat'l Gov't	Grant-Cash	727,270	18.7
GEF Agency (UNIDO)	Impl. Agency	Grant-Cash	50,000	1.3
GEF Agency (UNIDO)	Impl. Agency	Grant- In kind	100,000	2.6
BOAD Banque	Financial Inst.	Grant-Cash	3,000,000	77.4
Total Co-financing			**3,877,270**	**100**

* Percentage of each co-financier's contribution at CEO endorsement to total co-financing.

C. FINANCING PLAN SUMMARY FOR THE PROJECT ($)

	Project Preparation a	*Project B*	*Total c = a + b*	*Agency Fee*	*For comparison: GEF and Co-financing at PIF*
GEF financing	50,000	863,691	913,691	91,369	863,691
Co-financing	50,000	3,877,270	3,927,270		2,490,000
Total	100,000	4,740,961	4,840,961	91,369	3,353,691

D. GEF RESOURCES REQUESTED BY AGENCY(IES), FOCAL AREA(S) AND COUNTRY(IES)[1]

GEF Agency	*Focal Area*	*Country Name/ Global*	*(in $)*		
			Project (a)	*Agency Fee (b)*[2]	*Total c=a+b*
N/A	N/A	N/A	N/A	N/A	N/A
Total GEF Resources					

[1] No need to provide information for this table if it is a single focal area, single country and single GEF Agency project.

[2] Relates to the project and any previous project preparation funding that have been provided and for which no Agency fee has been requested from Trustee.

E. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	*Estimated person weeks*	*GEF amount($)*	*Co-financing ($)*	*Project total ($)*
Local consultants*	36	13,000	11,866	24,866
International consultants*	15	24,000	22,000	46,000
Total	**51**	**37,000**	**33,866**	**70,866**

* Details to be provided in Annex C.

F. PROJECT MANAGEMENT BUDGET/COST

Cost Items	*Total Estimated person weeks/months*	*GEF amount ($)*	*Co-financing ($)*	*Project total ($)*
Local consultants*	107	53,227	0	**53,227**
International consultants*				
Office facilities, equipment, vehicles and communications*		0	42,270	**42,270**
Travel*			8,000	**8,000**
Others**				
Total		**53,227**	**50,270**	**103,497**

* Details to be provided in Annex C. ** For others, it has to clearly specify what type of expenses here in a footnote.

G. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? yes ☐ no ☒

H. DESCRIBE THE BUDGETED M & E PLAN:

Project monitoring and evaluation (M&E) will be conducted by UNIDO team in accordance with established UNIDO evaluation system and GEF M&E principles. UNIDO will closely monitor and review the progress of the project activities through periodic meetings, field visits, and consultations.

The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by: i) tracking and reviewing project activities execution and actual accomplishments; ii) providing visibility into progress as the project proceeds so that the implementation team can take early corrective action if performance deviates significantly from original plans; and iii) adjust and update project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken.

A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the Project Coodination Unit (PCU) and project partners at the beginning of project implementation and then periodically updated.

The National Project Coordinator will be responsible for continuous monitoring of project activities execution, performance and track progress towards milestones. UNIDO project manager will be responsible for tracking overall project milestones and progress towards the attainment of the set project outputs. UNIDO project manager will be responsible for narrative reporting to the GEF.

A final external evaluation will be conducted six months upon completion of the project and will be conducetd by an independent party. The Strategic Results Framework (SRF) provides performance and impact indicators with their corresponding means of verification, which will be taken as a reference for monitoring the project's implementation, and for (independent) evaluation of performance and impact.

Table 1. Budget under M&E PLAN.

Activity	**GEF Funding**	**Cofinancing**
Final External Evaluation	14,000	10,000
Dissemination of Lessons Learned	7,000	
Total	**21,000**	**10,000**

PART II: PROJECT JUSTIFICATION:

In addition to the following questions, please ensure that the project design incorporates key GEF operational principles, including sustainability of global environmental benefits, institutional continuity and replicability, keeping in mind that these principles will be monitored rigorously in the annual Project Implementation Review and other Review stages.

A. STATE THE ISSUE, HOW THE PROJECT SEEKS TO ADDRESS IT, AND THE EXPECTED GLOBAL ENVIRONMENTAL BENEFITS TO BE DELIVERED:

The issue:

Côte d'Ivoire is a country with certain economic potential due to recent oil and gas production, a strong agricultural sector, which employs two thirds of the active population and constitutes the export base (cocoa beans, cofee and palm oil), and a very young population –median age is 19.4 years (2010 est.)[2]. However, it is still one of the poorest countries in the world, a situtation especially aggravated since the military coup d'etat in 1999 and the armed conflict of 2002. In 2009, Côte d'Ivoire was classified on the Human Development Poverty Index as 170 out of 182 countries. Almost half of the country's population (48.9%) is below the poverty line[3], the unemployment rate is estimated at 40-50% of the population, and the GDP per capita has declined 15% since 1999.

Most people (61%) still lack access to electricity today. In rural areas, electricity is considered a luxury. The access rate is only 14% in rural households, compared to 77% in urban areas. In those regions not serviced by electricity, charcoal, fuel wood and kerosene are the most important sources of energy. In 2006, 78% of the total population, i.e. 14.7 million people, still relied on fuel wood and charcoal for cooking[4].

Figure 1. Fuel wood in Attoumabo, N'zi-comoe region.

Figure 2. Karité seeds in Assoum 2, Zanzan region.

ELECTRIFICATION: The electricity sector of Côte d'Ivoire has an installed capacity of 1,210 MW, comprising 4,500 km of high-tension, 14,500 km of medium tension, and 10,500 km of low-tension lines (see Figure 3). Out of the 4,812 GWh produced 50% is produced from thermal stations and 50% from hydro power plants. The locally produced electricity is used to meet the national needs, and the remainder (1,237 GWh) is exported to neighboring countries. In

[2]Central Intelligence Agency (2010). The World Factbook: Côte d'Ivoire. Updated August 19, 2010, Retrieved August 25, 2010, from *https://www.cia.gov/library/publications/the-world-factbook/geos/iv.html*.
[3] 2008 est., UNDP.
[4] 2006 est., *World Energy Outlook 2008*, IEA/OCDE.

total there are 762,000 high low tension connections and 2,503 high tension ones (est. 2008)[5]. This is due to the Government having considered electricity coverage a priority of its development policy, which increased the rate of electricity coverage from 27% in 1997 to 39% in 2006. To achieve higher coverage and lower prices, the Government privatized in 1990 the national electricity company, CIE, and started a rural electrification plan in 1995 which aimed at providing electrification to 7,000 rural locations at a rate of around 200 a year. However, in 2004 it had only arrived to 355 locations, and in 2008 only 54 locations were electrified[6]. This plan is being updated regularly.

INSTITUTIONAL FRAMEWORK: The Ministry of Mines and Energy is the main body responsible for the energy sector in general, and since 2009 the Directorate of New and Renewable Energies is directly responsible for the promotion of renewable energy. The Government has created Renewable Energy Research Institutes, and established the National Committee for Solar Energy in 2000 with the mission of promoting electrification using renewable energy. Moreover, the Government has encouraged small-scale attempts to exploit solar and wind energy. In recent years, the public and private sectors as well as other organizations and NGOs have implemented a number of solar energy projects providing energy for pumping water, lighting public buildings and households, and powering telecommunications.

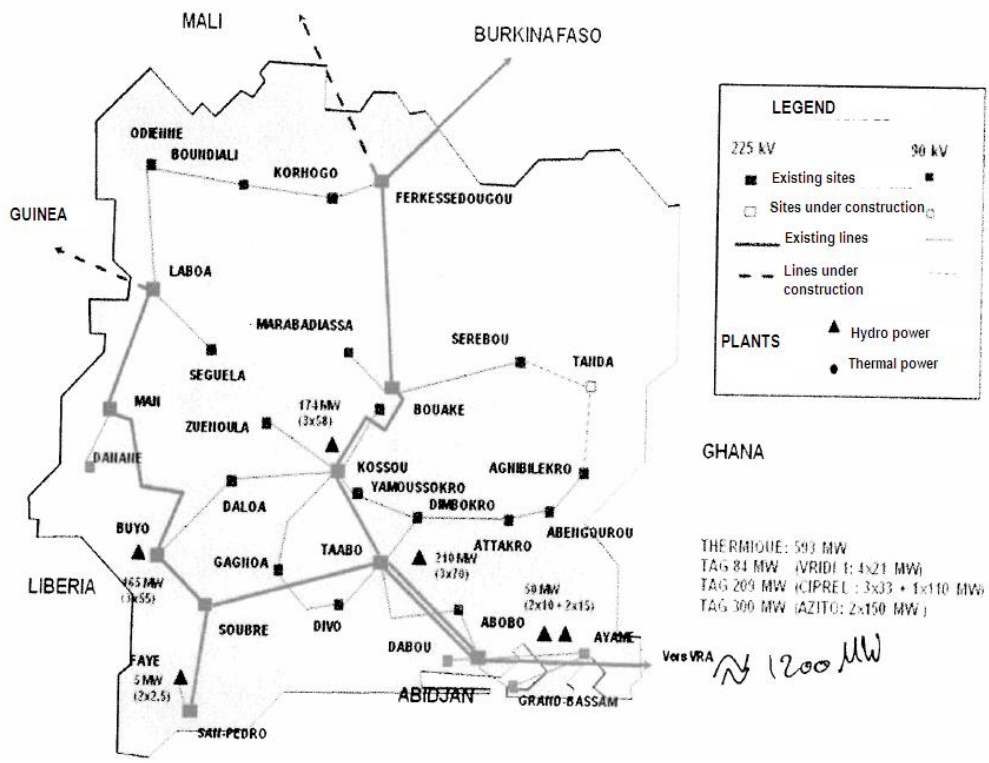

Figure 3. Power grids in Côte d'Ivoire.

TRADITIONAL WAY: The traditional way of providing access to modern energy services to the deprived two-thirds of the population of Côte d'Ivoire would be to increase the thermal generation capacity and extend the national grid to all regions and areas. Recognizing that extending the existing national grid to all rural areas would not be economically viable given the prohibitive costs related to power generation, and more importantly to power distribution, decision-makers are increasingly considering that the option of decentralized grids is financially more feasible. The current national plan is considering the establishment of decentralized grids powered by fossil fuels. However, this does not take into account the environmental impacts of this option: the use of fossil fuels to power the energy production in

[5] Gnigbognima, Siriki. *Éléments d'informations sure les secteurs de l'éléctricité et des énergies renouvelables en Côte d'Ivoire*. Unpublished report.
[6] Ibid.

these decentralized facilities will increase the country's GHG emissions. The solution is to establish mini-grids powered by the most suitable renewable energy system locally available, such as biomass, small hydropower, or photovoltaics. Based on life cycle calculations, the use of these renewable resources in decentralized grids will be the most economically and financially viable option to providing access to "cleaner" energy and triggering economic activities in off-grid areas.

RENEWABLE ENERGY POTENTIAL: This approach is all the more promising since Côte d'Ivoire has a large potential to generate electricity from renewable energy. This is especially true for solar energy, since the country has solar irradiation values estimated at 4-5 kWh/m2/day or 2,200 kWh/m2/year, and an irradiation duration of 6 hours a day. There is also considerable potential for small hydropower and biomass (the latter on the basis of the agricultural residues available in the country and on other wastes), which have not been exploited so far.

CONSTRAINTS: However, the establishment of viable and functional renewable energy-powered decentralized mini grids in rural areas in Côte d'Ivoire faces a number of barriers, which are specific to the use of renewable energy to power mini-grids. The most important constraints are the following:

1. Weak legal and regulatory frameworks, and lack of financial mechanisms: There is a need to enhance the coordination among the existing institutions in charge of renewable energy, and set up new mechanisms to support the involvement of the private sector in renewable based rural energy access, as well as to promote public-private sector partnerships through financial mechanisms.

2. Lack of information on available renewable energy resources and its feasibility: The renewable energy resources in the country have not been assessed in detail, so it is difficult for the private sector, investing institutions and other stakeholders to have a clear and informed picture to start using these resources to develop renewable energy enterprises. There is also a need to demonstrate the technical feasibility and commercial viability of renewable energy projects in order to attract private sector participation in the dissemination and adoption of these technologies.

3. Lack of technical capacities: There is a lack of local technical capacities to identify, design, construct, instal, manage, operate, and maintain renewable energy based decentralized grids.

The project:

The project is expected to remove the institutional, technical, knowledge and awareness-related barriers to the promotion of a market approach for renewable energy based mini grid systems to meet the growing needs for electricity in rural areas, which is currently met or likely to be met by fossil fuels such as oil lamps, batteries and diesel generators.

The project aims at promoting solar photovoltaic based mini-grids in order to increase the rate of moderen energy access of the rural populations to replacing the presently used fossil energies. This is through an integrated approach that combines substantial capacity building and learning-by-doing with technical assistance interventions at the policy and demonstration project level.

The project will focus mainly on (i) creating a critical mass of skilled and knowledgeable technicians and public officers; (ii) building awareness, specially of the private sector, about the appropriate technologies and the best practices; (iii) linking energy services with productive uses, and (iv) formulating and strengthening policies encouraging the involvement of the private sector and promote providing access to innovative and smart financial mechanisms.

Besides removing the afore-mentioned barriers, the end of project situation will include establishing of a total of 120 kW photovoltaic based generation capacity, composed of 3 photovoltaic based mini grid facilities.

The project will thus establish 3 pilot demonstration sites in off-grid isolated communities and implement the pilots through the learning by doing approach and by building local capacity. The pilot sites will also be used to increase awareness about RE technologies for rural electrification among different actors and stakeholders (financial institutions, private sectors, service providers, local governments, etc.). The project will review the existing policy and regulatory framework and formulate recommendations to strengthen this framework so as to promote investment by the private sector for rural electrification projects. The selection criteria of the pilot sites have included the potential for the productive use of the energy generated the therefore income generation contributing to the financial sustainability of the energy enterprise and private investment.

To achieve the targets, the project will work with national partners, at the central and local government levels, with private sectors, as suppliers and service providers, and with local banks and financial institutions. The project will cooperate with the Directorate of New and Renewable Energies of the Ministry of Mines and Energy, in the monitoring, evaluation, and dissemination of activities. Local private sector providers will be trained and assisted in identifying, and setting of electricity delivery services in rural areas. Training will be provided in the installation, and maintenance of equipment. Local Village Organizations will be encouraged to organize service delivery. Local financial institutions will be provided with assistance in preparation for their role in the financing mechanism.

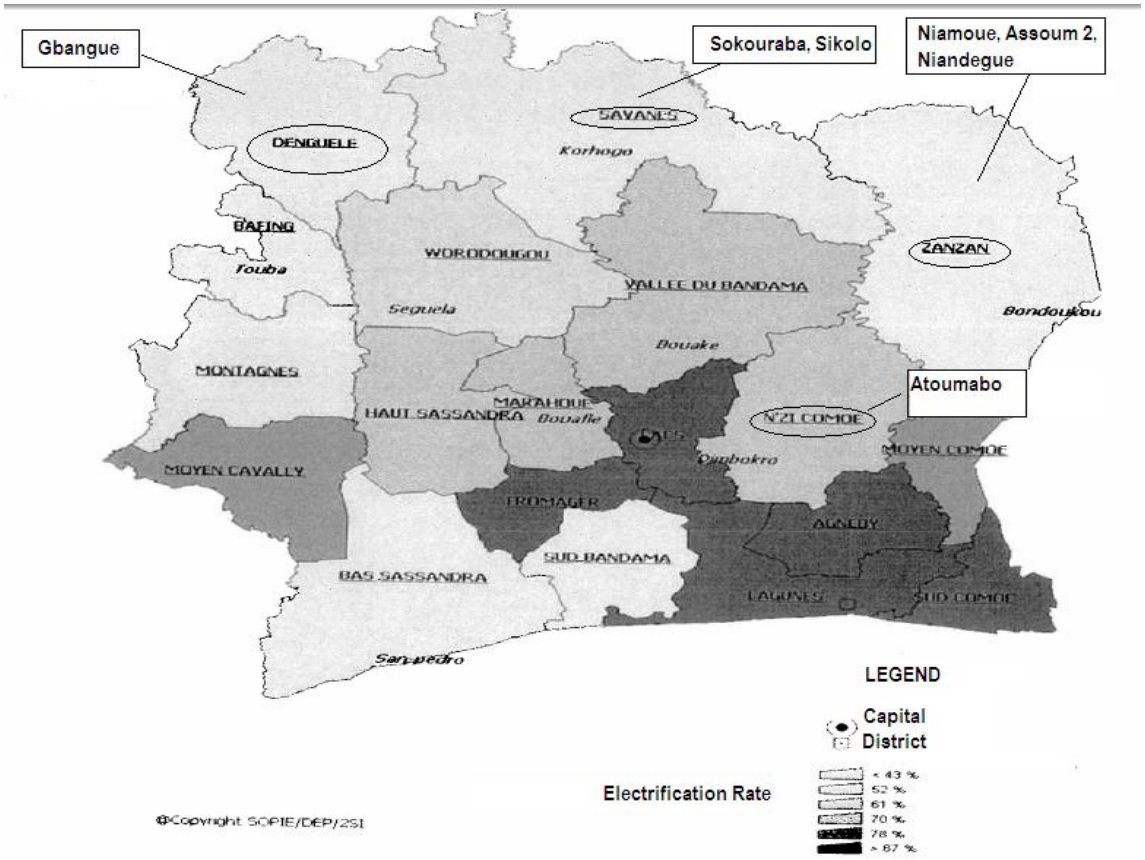

Figure 4. Electrification rate and location of selected sites.

How the Project intends to solve these problems?

This project seeks to reduce the institutional, technical and financial barriers so that a better understanding of the potentials of photovoltaic energy resources is achieved and sustainable pathways to valorizing these resources are promoted with the involvement of the private sector. The project aims at promoting solar PVbased mini-grids in order to increase the rate of access of the peri-urban and rural populations to electricity and replacing fossil energies. This is

through an integrated approach that combines substantial capacity building and learning-by-doing with technical assistance interventions at the policy and demonstration project level.

Primary target beneficiaries of the project are energy policy-making and implementing institutions, primarily the Ministry of Mines and Energy and Directorate of Energy, potential energy generators (managers and engineers), rural energy users, training institutes, energy professionals & service providers and the financial sector.

The project will work with the national stakeholders and and conterparts, led by the Directorate of Energy, Ministry of Mines and Energyl and with National and International experts and will build and strengthen institutional technical capacity and deliver the project designed outputs.

The project consists of 3 main components, and a monitoring and evaluation component, designed to be the main axes of the project strategy to solve the identified problems and barriers:

Component 1 (C1) Institutional, policy and financial mechanisms : this project component aims at strengthening the policies and regulatory mechanism to effectively promote and support market based development through measures encouraging public-private sector partnership and smart financial mechanisms. This will be done through raising the awareness and building the capacity of the stakeholders, conceiving and formulating an effective, market-oriented policy framework to stimulate investments in renewable energies.

Component 2 (C2) Identification of a portfolio of solar PV sites and preparation of feasibilty studies: this project component will improving existing information and data on PV potential sites by preparing prefeasibility studies on a number of sites indication parameters related to their generation potentials, socio economic profiles of beneficieries, estimated costs. This will facilitate replication and enable, for the decision makers, the prioritization of investment, and will provide the private sector developers and investors with a tool to make informed selection and decide on the needed inputs to develop a given site into a sustainable clean energy interprise.

Component 3 (C3) Technology demonstration and creation of awareness and technical capacities: this project component aims to demonstration the technical and economic feasibility of the photovoltaic based mini grids and using the process for on job training and the creation of technical capacities. Beside providing access to clean energy for productive use, the established photovoltaic based mini grids will raise the awareness of private sector investors, financing institutions, developers and donors on the untaped potentials for producing clean energy and GHG emission reductions.

The final project component comprises the **management and evaluation activities, C4).**

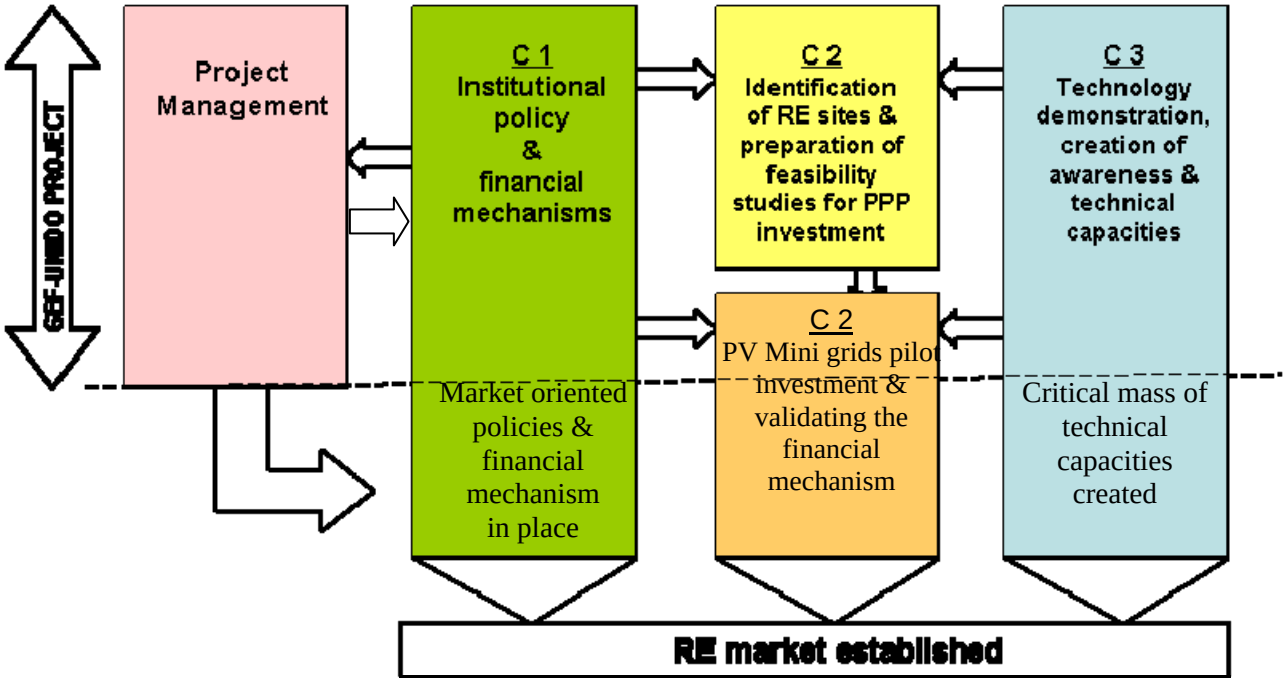

FIGURE 5: INTERACTION BETWEEN THE PROPOSED PROJECT COMPONENTS

The figure 5 shows how the project components interact together to enable the facilitation of a renewable energy market in Cote d'Ivoire. The following pages provide more details of each of the project components.

Project component 1: Institutional, policy and financial mechanism: Development of legislation and institutional capacities in favor of renewable energies will create an environment favorable to the renewable energy market. The financial support of renewable energy projects will be improved through the increased capacity of the local banks to evaluate the RE investments. Seminars and workshop will be organized to gather the local banks, the project staff and the private operators.

- The project will provide technical assistance to the Energy Directorate for reviewing the existing legal texts and developing and adopting new regulations in order to clarify the institutional landscape and attract the private sector to the RE market .

- A dialogue with the various actors and stakeholders will be established striving to ensure that the existing energy policy framework take the followings into account:

  - Preparation and adoption of a decree or a guidelines document on a tax reduction on the solar and other renewable energy equipment for generation, transport and distribution stations of renewable energies (solar modules, inverters, regulators, receivers etc…).
  - Preparation and adoption of a guidance document on the legal status of exploitation of power services, and the terms and conditions of leasing, the management of an electrical installation by natural or moral persons other than the national utility.

Project component 2: Identification of solar PV resources and preparation of feasibility studies: An evaluation of the potential sites for replication will be undertaken.
The studies will generally relate to the following aspects:

- Detailed inventory on the studies carried out in Cote d'Ivoire on renewable energy potential.

- Geographical distribution/availability of the energy sources, potentials end uses and exploitation constraints.
- Identification of potential sites for the realization of the technical feasibility studies, and economic viability in order to facilitate the installation of the marketable systems of renewable energy based grids.
- Final choice of the portfolio pilot sites for replication and investment.

The studies will relate to the data on the solar radiation in a certain number of cities and villages of Cote d' Ivoire, which is being based on the current data of the Management of Meteorology and the Water resources. It is also a question of looking further into the knowledge of the weather data necessary to the determination of the parameters of dimensioning of received solar energies some is the point considered in place of the territory of Cote d' ivoire had.

The outcomes include information and data on potential sites for investment, in a form of parameters related to their generation potentials, socio economic profiles of beneficieries, estimated costs. This will facilitate for the decision makers the prioritization of investment, and will provide the private sector developers and investors with a tool to make informed selection and decide on the needed inputs to develop the site into a sustainable clean energy enterprise.

Project component 3 Technology demonstrations and creation of awareness and technical capacities: The technical-economic viability of the mini-grid systems based on photovoltaic solar energy will be demonstrated as alternative to the electric generators using fossil fuels. While the demonstration mini grids are to be used for awareness building of various stakeholders (policy and institutional, financial institutions and services providers) in the public and private sectors, the process of establishing these pilot demonstration photovoltaic based mini grids is used to build technical capacities on a learning by doing based, on the range of skills needed to put in place and operate and manage a photovoltaic based mini grid in rural and peri-urban Cote d'Ivoire. Special attention will be given to promoting the investments through facilitating public private partnership, among others, by providing technical and commercial information, as well as through promoting the productive uses of the clean energy produced. The lessons learned and the best practices will be published in order to disseminate knowledge and accelerate the removal of the existing technical and practical information barriers.

During the PPG phase, the project has pre-identified several villages and communities, please see Annex H. The communities have been surveyed to identify their needs. Special attention has been given to existing and potential productive uses (water pumping, battery charging and cottage and small industries)in the zone to be served, as well as, the ability and willingness to pay for the energy services. Based on pre defined criteria, such as the existing and potential economic activities and the existence of fossil fuel generators, the communities are to be prioritized for establishing the pilot demonstration solar photovoltaic based mini grids.

The Pre-feasibility studies undertaken during the preparatory phase identified the daily load characteristic and users profile of the sites and defined the outlines of system specifications, components and dimension in function of a number of factors mainly the solar radiation intensity. The cost of photovoltaic based mini grid is estimated to be around USD 600,000 for 50 kW capacity. The project targets the installation of around 7 pilot photovoltaic based mini grids of around totaling 350 kW, installed and operational by the completion of the project. In total approximately 1750 households and small local businesses will be served in the sites to be served by the photovoltaic mini grids. This is corresponding to approximately 8750 persons served by access to clean electricity by 2014.

During the project implementation phase, the process of establishing the clean electricity production and distribution facilities is to commence with the preparation of the detailed feasibility studies for the selected sites/communities. The pilot mini grid, photovoltaic based facilities will be established to serve as a demonstration, to the stakeholders at large, of the environmental, technical and economic viability of the system in comparison with fossil fuel based generation.

The process of establishing the pilot demonstration mini grids will be used as a learning-by-doing approach to building the technical capacities in the various skills and disciplines that are involved, starting from site identification, socio economic studies, load profile, designing and dimensioning of the systems and its components, detailed engineering, construction and electromechanical installations, start up, operation and maintenance of the facility, and management of the energy enterprise. It will also be a source for generating case specific lessons learned and knowledge to be taken into account in replication and for establishing best practices for the prevailing and evolving socio-economic and technical conditions of Cote d'Ivoire.

The local technical capacity of the stakeholders at large will be increased through the dissemination of a publication of lessons learned and best practices, as well as seminars and exchange meetings to inform the different actors on the impact of these energies on the environment.

The photovoltaic based mini grid facilities in the pilot selected cities and communities will be used as demonstration sites in order to attract private operators to invest in the sector, in partnership with the public sector, and help the Government to achieve the developmental and environmental goals.

The demonstration projects, therefore, will generate national renewable energy case studies and best practices that would be relevant to and have good replication potential in Cote d'Ivoire on the sustainable pathway to delivering GHG emission reductions, while achieving national developmental goals.

Whenever possible the business associations (cooperatives) specifically for women will be established specifically for management, operation and maintenance and productive uses of the energy produced. In the associations where men and women are members, women will be encouraged and supported to be in the management level. To increase the number of women in the associations, all efforts will be made not to overburden them by work (additional house hold work) a flexible working time.

Activities of the Project components

Component 1: Institutional, policy and financial mechanism

C1. Output 1.1: Draft strategic framework for RE energy is prepared and ready for adoption.

TABLE 3. ACTIVITIES FOR OUTPUT 1.1

Activity	*Main Responsibility*	*Estimated completion date*
1.1.1 Review existing policy and regulatory framework and prepare a strategic framework for renewable energy development espcially focusing on private sector involvement in rural areas under public-private partnership models. 1.1.2 Strategic framework is presented to local authorities for consideration	International consultant and national multidisciplinary experts team	Spread over the duration of the project

C1. Output 1.2: Institutional framework for the energy sector is clear and effective.

TABLE 4. ACTIVITIES FOR OUTPUT 1.2

Activity	*Main Responsibility*	*Estimated completion date*
1.2.1 Consultative and awareness building workshops to ensure that main actors of the energy sector and RE subsector in particular understand their role, and act in an effective manner for the promotion of a RE market. 1.2.2 Document outlining the institutional framework is develoed and widely disseminated.	International consultant, national multidisciplinary experts team, and PCU	Spread over the whole project period with focus on the start, during the construction of the pilot facility and after the establishement of the facilityies.

C1. Output 1.3: Local financial service providers aware of and have expertise in analysis and evaluation of the risks related to the investments on renewable energies.

TABLE 5. ACTIVITIES FOR OUTPUT 1.3

Activity	*Main Responsibility*	*Estimated completion date*
1.3 Awareness and capacity building workshops for local financial service providers.	International consultant, national multidisciplinary experts team, and PCU	Spread over the whole project period with focus on the start, during the construction of the pilot facility and after the establishment of the facilities.

C1. Output 1.4: Public-private partnership mechanism formulated and promoted

TABLE 6. ACTIVITIES FOR OUTPUT 1.4

Activity	*Main Responsibility*	*Estimated completion date*
1.4.1.Formulating a financial mechanism promoting PPP	International consultant, national multidisciplinary experts team	18 months after the start
1.4.2 Awareness and capacity building workshops for public officers, project developers, equipment suppliers, etc., on the RE investment opportunities in facilities providing access to energy	International consultant, national multidisciplinary experts team, and PCU	Spread over the whole project period with focus on the start, during the construction of the pilot facility and after the establishment of the facilities.

Component 2: Identification of RE resources and preparation of feasibilty studies for ppp investments

C2. Output 2.1: Project sites identified for the installation of viable RE systems, and prioritized following a pre-defined set of criteria promoting productive uses

TABLE 7. ACTIVITIES FOR OUTPUT 2.1

Activity	*Main Responsibility*	*Estimated completion date*
2.1.1. Identifying and prioritizing RE projects, determining the technical and economic potentials, and identify potential end users	International consultant and national multidisciplinary experts team	8 months after start

C2. Output 2.2: Detailed feasibility studies prepared.

TABLE 8. ACTIVITIES FOR OUTPUT 2.2

Activity	*Main Responsibility*	*Estimated completion date*
2.2.1 Preparing pre-feasibility studies for the installation of 10 viable RE systems by investors and prioritizing them following a pre-defined set of criteria focusing on productive uses and economic development.	International consultant and national multidisciplinary experts team	9 months after start

Component 3: Technology demonstration and creation of awareness and technical capacities.

C3. Output 3.1: Feasibility studies of photovoltaic based mini grids power facilities prepared.

TABLE9. ACTIVITIES FOR OUTPUT 3.1.

Activity	*Main Responsibility*	*Estimated completion date*
3.1.1. Preparing technical / financial feasibility study for the selected sites to be constructed as pilot demonstrations, and identifying the appropriate managing modality of the energy production enterprise.	Ministry of Energy with support from UNIDO staff, international consultant and national expert,	6 months after start
3.1.2. Preparing a turn key subcontract for designing, constructing, installing equipment, constructing transmission and distribution lines, training a team of operators and undertake special campaign to raising the awareness of beneficiaries and other local stakeholders. Undertake international bidding process following UNIDO rules and regulations; select the technically and commercially acceptable best offers. Award the subcontract.	UNIDO staff	10 months after start

C3. Output 3.2 Construction of pilot plants on selected sites completed

TABLE 10. ACTIVITIES FOR OUTPUT 3.2

Activity	*Main Responsibility*	*Estimated completion date*
3.2.1. Civil work and Equipment procurement – progress reports	Sub-contractor, international consultant, national multidisciplinary experts team, PCU	15 months after start
3.2.2. Installation of equipment, transmission and distribution lines, start up testing and commissioning- progress report	Sub-contractor, international consultant, national multidisciplinary experts team, PCU	25 months after start
3.2.3. Training of multidisciplinary team through on-job training on the issues of construction, commissioning, operation and maintenance & management - progress reports	Sub-contractor, international consultant, national multidisciplinary	28 months after start

	experts team, PCU	
3.2.4. Developing manuals and handbooks for operation, maintenance and management.	Sub-contractor, international consultant, national multidisciplinary experts team, PCU	29 months after start
3.2.5. Preparing As-built documents and final report	Sub-contractor, international consultant and the national experts	30 months after start

C3. Output 3.4: Training of a team local authority officers and interested private sector service providers-to-be on operation, maintenance and management provided.

Table 11. Activities for output 3.3.

Activity	*Main Responsibility*	*Estimated completion date*
3.3.1 Training of local authority officers and interested private sector service providers-to-be through on-job training on the issues related to operation and maintenance & management 3.3.2 Toolkits and final report compiled and widely disseminated.	Sub-contractor, national multidisciplinary experts team, PCU	32 months after start

Global environmental benefits:

The global environmental benefits of the project will be the reduction of GHG emissions by promoting renewable energy based mini-grids for rural electrification and productive uses needs of the rural and peri urban areas.

- **<u>Direct emissions reductions</u>**:

  This project is conceived for the installation of pilot photovoltaic based mini grids of a total power of 350 kW capacity. Research conducted for the project preparation indicated the range of 15-25 % as capacity factors experienced by photovoltaic systems. Considering the case of Cote d' ivoire where solar irradiation is one of the highest in the world and taking into account the fact that the efficiency photovoltaic cells decrease with the increase of temperature (above 35 degree cellecious) the capacity factor is therefore considered to be 20%. Consequently, working at 20% of its generating capacity (capacity factor[7]), the photovoltaic system will generate, 350 kW * 0.20 X 8,760 hours, 613 MWh/yr, as being the result of the project or 6,123 MWh by taking into account of the lifetime duration of the facilities, which is 10 years.

  Research conducted for project preparation documents have determined the average CO2 intensity for diesel generators to be 0.9 tonnes of CO2 equivalent per MWh. This means that given the quantity of the photovoltaic electricity produced, and the carbon intensity of the electricity supplied by generators, the proposed project will

[7] By "capacity factor" it is meant the straight ratio of average power generation by the system to the rated power of the system.

lead to the direct emissions reduction of approximately 8,279 tons of CO2 equivalent over the estimated life time of 15[8] years.

- **Direct Post-Project Emission Reductions:**

This GEF project will formulate a financial mechanism and propose it for operationalization. The project therefore will not finance the financing mechanism, or any sort of component, that will continue to operate after the project closes and catalyze GHG emission reductions. Therefore, no direct post-project emissions reductions will be achieved by the project.

- **Indirect Emission Reductions:**

(1) Using the GEF bottom-up methodology, indirect emission reductions attribuable to the project are 33,116 tonnes of CO2 equivalent. This figure assumes a replication factor of 4.

(2) With Cote d'Ivoire's solar insolation of 4 to 5 kWh per square metre per day, the solar energy potential of the country is approximately 700,000 MWh per year. Research at the PPG stage indicates that an economically and technically viable potential for solar electrification is about 60 GWh of energy supply over the next 15-20 years. This results in 53,400 tons of CO2eq of GHG emissions avoided. Assuming a causality factor of 60% from the project, gives a GEF top-down methodology indirect emission reductions attributable to the project of 32,000 tons CO2eq.

TABLE 13: EMISSION REDUCTION OVERVIEW.

Measure	Emission Reduction (t CO2) Load factor 20%
Direct	8,279
Direct Post-project	0
Indirect Bottom-up	22,594
Indirect Top-down	32,000

[8] 15years has been selected as the life time of this project versus the GEF guideline of 10years. This is due to the fact that PV technology has significantly improved over the last few years and recent projections show that the technology can even have longer life time.

B. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH NATIONAL AND/OR REGIONAL PRIORITIES/PLANS:

National Level:

The project is consistent with the national priorities since the Government of Côte d'Ivoire has accorded special priority to renewable energy utilization through various policies and institutional measures as shown below:

1. **National Anti-Poverty Programme (1997-2000):** This program aimed at bringing rural electrification to 200 rural localities per year. However, objectives were not achieved as planned.

2. **First National Communication (2000):** The proposed project will support key mitigation mechanisms identified in the First National Communication, such as the promotion of energy production from renewable energy resources.

3. **Liberalization of Energy Sector (2000)**: In line with the efforts of providing a greater access to modern energy and reducing electricity costs, the Government decided to liberalize the energy sector by privatizing the Compagnie ivoirienne d'électricité (CIE) and adapting the regulatory framework to a liberalized energy sector. The proposed project will contribute to establishing a market for solar PV systems in order to attract the private sector.

4. **Creation of National Committee for Solar Energy**: The National Committee for Solar Energy (created in 2000) with the mission of promoting electrification using renewable energy, especially in rural areas, so as to increase access to modern energy services and consequently reduce and reverse deforestation caused by the unsustainable harvesting of firewood.

5. **National Energy Policy (under development)**: The proposed project will contribute to the four main objectives of the National Energy Policy: (1) energy security, (2) satisfaction of the national energy demand, (3) energy access to the most disadvantaged, and (4) protection of the environment and promotion of new and renewable energy[9]. More concretely, in the renewable energy subsector, the Policy aims at decentralizing the energy systems, protecting the environment, evaluating the potential in solar, biomass and wind power, and increasing the proportion of renewable energy from 0% to 3% by 2013, and to 5% by 2015.

6. **Public Declaration (2002)**: The Prime Minister declared in the National Assembly in February 2002 that Government intended to pursue rural electrification and the extension of the network in urban zones that already receive electricity so as to improve the well-being of the population, and to bring them the energy necessary for development.

7. **Reform Program (2007)**: When the transition government took office in 2007 and requested Emergency-Post Conflict Assistance (EPCA) from the IFM, it launched a reform program that aimed to increase governance and transparency in the energy sector, among other objectives. In 2007, the Government launched three audits, financed by the World Bank, in the areas of oil/gas exploration, development and production, oil refining, and electricity. The findings of the audits indicate the need to introduce a clear and attractive regulatory framework and adopt industry standards. Component 1 of the proposed project aims at assisting the institutions to develop a framework for the introduction of modern energy services.

[9] Gnigbognima, Siriki. *Éléments d'informations sure les secteurs de l'éléctricité et des énergies renouvelables en Côte d'Ivoire*. Unpublished report.

8. **Poverty Reduction Strategy Paper (2009)[10]:** In the PRSP, the Government has formulated actions needed to improve the performance of the energy sector in general, such as an increase in electricity rates by 10% on average, a reduction in the VAT, and regular payment of government's current bills.

9. **Heavily Indebted Poor Countries (HIPC) Initiative**: Côte d'Ivoire is part of the 42 African countries classified as heavily indebted –public debt is as high as 61.9%- (2009 est.)[11]. A nationwide improvement in the rural electrification network has been identified as one of the possible medium-term expenditure priorities for the use of HIPC savings.

10. **Millennium Development Goals**: The proposed project will contribute to target 10 of reducing by half, by 2015, the percentage of population without access to clean water and basic sanitation services by using energy systems to pump water (Indicator 27- Energy consumed by unit of GDP produced, 0.27 per 1,000 in 2002).

Regional Level:

At a regional level, the GEF Energy Component program of which the proposed project is part is line with the regional priorities and plans of ECOWAS and UEMOA, especially the following policies:

1. **ECOWAS**: The White Paper for a Regional Policy on Energy Access (January 2006) encourages the use of RE technologies to increase the access to energy in support of the MDG.

2. **NEPAD**: The priorities identified in the action plan for the environment initiative and the energy plan of the New Partnership for Africa's Development (NEPAD).

3. **Dakar International Conference on Renewable Energy in Africa** (April 2008): The energy component also takes into consideration the key strategic concerns and outcomes of the Dakar International Conference on Renewable Energy in Africa and its Action Plan, especially the Dakar Declaration On Scaling Up Renewable Energy in Africa.

C. DESCRIBE THE CONSISTENCY OF THE PROJECT WITH gef strategies AND STRATEGIC PROGRAMS:

The project is consistent with the GEF Climate Change focal area, and more specifically with Strategic Programme/ **SP 3 - Promoting market approaches for Renewable Energy**: this project will "promote on-grid renewable energy" and contribute positively to the market transformation process by the implementation of viable and sustainable RE pilot projects, which will enable the Government to further establish the appropriate policy and regulatory framework and contribute to climate change mitigation through replication of such projects.

D. JUSTIFY THE TYPE OF FINANCING SUPPORT PROVIDED WITH THE GEF RESOURCES.

The context and barriers analysis, as well as stakeholders discussions carried out during the PIF preparation and PPG implementation, have clearly indicated that

- the Government has insufficient resources, lacks the technical expertise and institutional capacity to autonomously structure and implement programs to promote and support the development of PV based mini grids in the short- to medium-term.
- the limited and partial expertise currently available in Côte d'Ivoire is not going to be addressed without the transfer of expertise and best practices.

[10] International Monetary Fund (2009). *Côte d'Ivoire: Poverty Reduction Strategy Paper*. Retrieved August 24, 2010, from http://www.imf.org/external/pubs/ft/scr/2009/cr09156.pdf

[11] Central Intelligence Agency (2010). *The World Factbook: Côte d'Ivoire*. Updated August 19, 2010, Retrieved August 25, 2010, from *https://www.cia.gov/library/publications/the-world-factbook/geos/iv.html*.

- to convince enterprises that investing in modern clean energy makes good economic and environmental sense, the availability of a sufficient number of national success stories is a critical component of any effective promotional and educational campaign.

The project is targeted to address and remove existing policy gaps and technical capacity barriers at the institutional and market level by providing technical assistance. GEF resources are needed to secure incremental international and national expertise, human resources and services needed to address and remove many of identified barriers to renewable energy.

The GEF resources being requested for this project will be targeted towards establishing a market environment that will promote investments in renewable energy based mini-grids in rural areas. The GEF funding will be used to co-finance project activities leading to:

(1) Avoiding new GHG emissions during the development of the rural electricity sector in Côte d'Ivoire.

(2) Developing an RE market by overcoming institutional, administrative, technical and financial barriers that prevent RE based grids from being a significant part of the energy supply mix.

(3) Promoting a market approach, and encourage the participation of the private sector to develop mini-grid connected RE systems for meeting the growing demand for electricity thereby supporting sustainable socio-economic growth.

(4) Developing 7 pilot mini grids to demonstrate the technical feasibility and economic viability of renewable energy for energy access and promoting productive uses;

(5) Supporting independent evaluation and monitoring of the pilot projects to document the best practices that can be applied to other similar projects.

E. OUTLINE THE COORDINATION WITH OTHER RELATED INITIATIVES:

Recognizing the challenges in the energy sector in Côte d'Ivoire, Government has spearheaded a number of initiatives whose overall goal is to promote renewable energy technologies in general in particular. In particular, this project will coordinate and link up to these ongoing and/or planned initiatives in order to build synergy and avoid overlaping:

1. **GEF Strategic Program for West Africa: Energy Component and the GEF** SPWE Coordination MSP**:** This project is being developed as part of the regional GEF Project entitled "Strategic Program for West Africa: Energy Component". At the regional level, it will be coordinated and harmonized with other UNIDO projects implementing national market transformations to promote solar energy (PV and solar thermal applications) in Benin, Ghana, Mali, Senegal and Sierra Leone. This regional harmonization and coordination will be undertaken through ECOWAS (the Economic Commission of West African States), of which Côte d'Ivoire and all the other countries are members. Because ECOWAS has a focus on promoting renewable energy among its members, it is by far the most suited regional institution to organize the coordination and harmonization between these GEF projects. Through ECOWAS, policies and strategies to promote market-based RE powered mini-grids will progressively be expanded to all countries in the region. The present project will therefore liaise with these specific regional activities under the umbrella of the GEF Programmatic Energy programme for West Africa led by UNIDO. Provisions to undertake this coordination will be part of the coordination mechanism of the programme as envisaged in the PFD.

2. **Système d'hydraulique villageoise ameliorée, HVA**: The project can also coordinate with this program for the provision of potable water to rural communities. In order to benefit from this program, the localities must fulfill certain criteria such as having undergone electrification. Some of the power from the mini-grids can also be

used for water pumping systems. Therefore, joint planning will have to be done to ensure that the electrification plan concides with the water pumping plans.

3. **GIZ's Rural Economic Development**: This Project aims at increasing the income of agricultural and non-agricultural businesses. The proposed project can beneficially coordinate with it since a primary focus of the pilot projects will be to ensure that the electricity produced is used for generating income. The plannning of the mini grids under this project will be intrelinked to this project to ensure that, where possible, part of the mini grids can also support the income generation activities in line with the over objectives of this project. In addition, this project can also target villages that already have ongoing income generation activities as they will have the ability to pay for the energy delivered by the mini grids.

F. DISCUSS THE VALUE-ADDED OF GEF INVOLVEMENT IN THE PROJECT DEMONSTRATED THROUGH incremental reasoning :

The GEF funding is being requested for this project to help remove the barriers to establishing a market environment that will promote investments in renewable energy based mini-grids in rural areas. The GEF funding will provide the necessary support to demonstrate the technical feasibility and economic viability of mini hydro based mini grids and promote productive uses. GEF co-financing will provide the necessary support to demonstrate the technical and commercial viability of renewable energy projects. The demonstration effect will be significant in helping to remove identified barriers currently preventing potential stakeholders from implementing RE projects. GEF co-financing will provide technical assistance to promote public private partnership and scale-up of renewable energy and will provide the technical assistance to establish a legal and regulatory framework that would create support for renewable energy. Further, GEF co-financing would provide technical assistance for institutional strengthening, capacity building and awareness raising to create a supportive institutional framework. In so doing, GEF co-financing will contribute largely increasing energy access; promote economic development while avoiding new GHG emissions during the development of the rural electricity sector in Cote d'ivoire.

Without the approach of the GEF, the search for solutions to increase the access to electricity would likely not focus on selecting the best option taking the environmental impacts into consideration.

Without the GEF project, the "business as usual" scenario involves either reliance on fossil fuels for electricity generation, either oil lamps, generators, and batteries, in rural areas as the scenario with the least cost expensive option, or a continued lack of access to modern energy services in these areas. Under this scenario, the solar energy potential in the country will continue to be underexploited, and the use of renewable energy resources will remain restricted to niche markets. PV based grids will not be used in rural areas on a large scale to increase rural electrification rate. Since no modern energy leads to no development, conventional energy based solution would pop-up with its impacts on local and on global environment.

The overarching purpose of the present project activities is to assist the Government to protect the environment by promoting locally available energy sources, while striving to increase energy access as part of its developmental goals. This vision is in line with the constraints induced by fossil energies, and also with the renewable energy resources available in Cote d'ivoire. Lastly, the measures recommended in this project, will lead the Cote d'Ivoirian private operators to become major actors in the promotion of renewable energies of productive use.

Baseline scenario:
There are significant limitations in terms of the capacity of the stakeholders to facilitate a renewable energy market. There are limitations at each level from the Ministry of Mines and Energy in terms of lack of reliable information and data on potential renewable resources and week ability to deliver and prepare new policy, etc. Ministry of Mines and Energy currently has no capabilities to develop photovoltaic based power projects so needs significant training if it is to

play a significant role in developing the market in the future. In addition, the finance institutions and the private sector do not have reliable information, knowledge or experience of renewable energy and therefore do not understand the risks and opportunities and therefore are not lending or investing in potential projects.

The Government is well aware of its resource and capability constraints and for this reason is seeking international support from both multilateral and bilateral donors.

Baseline trajectory

In the absence of the proposed GEF-UNIDO project very few steps, if any, towards the development of photovoltaic based mini grids for energy access and productive uses, are likely to be made in the short and mid -terms. Without the GEF project, the "business as usual" scenario involves either reliance on fossil fuels for electricity generation in rural areas as the scenario with the least cost expensive option, or a continued lack of access to modern energy services in these areas. Under this scenario, the clean solar resource potential in the country will continue to be underexploited, and the use of renewable energy resources will remain restricted to niche markets. Photovoltaic mini grids will not be used in rural areas on a large scale to increase rural electrification efforts. Since no modern energy leads to no development, conventional energy based solution would pop-up with its impacts on local and on global environment.

The cost of the baseline senario of the direct and indirect deliverables of this project is estimated at 800,000 USD.

GEF alternative scenario

GEF assistance will catalyze market based scale-up and replication of photovoltaic renewable energy in rural areas by addressing barriers related to capacity building and awareness, increasing appreciation of the technical feasibility and economic viability of photovoltaic technologies, and promoting financial mechanisms which will attract the involvement of the private sector.

GEF funds will be used to pilot an approach of establishing demonstration sites of photovoltaic -based renewable energy services, while using the process for learning-by-doing practices and on-job training to develop different types skills and knowledge, and supplying the electricity generated to the local isolated communities for basic services and income generation activities. The project is expected to lay the foundation for market environment for photovoltaic -based renewable energy for the first time in Cote d'Ivoire, and will have a significant demonstration effect. If successful, the GEF support will enable the Government to scale up and replicate the project achievements across the country. As such, GEF support will ensure that (i) commercialized development of renewable photovoltaic power and GHG avoidance are sustained by removing technical, policy and capacity barriers; and (ii) it is demonstrated that the electricity generated from renewable sources can be used sustainably in rural areas. These activities will contribute towards GHG emission reduction through avoidance of potential future use of fossil fuels, as well as to the economic and social development of Cote d'ivoire's rural areas.

GEF involvement, therefore, adds value in taking the development of photovoltaic -based energy services several steps further. GEF intervention has triggered co-finance from the West Afria Development Bank, BOAD to the toon of USD 3 Millions. It will further trigger co-financing, mainly from multilateral agencies and the private sector. Multilateral agencies will also take advantage of the political commitment to photovoltaic -based renewable energy and the established market environment to support viable and effective investments in renewable energy mini grids in rural areas. Once market barriers are removed, the private sector at the local and international level is expected to take advantage of business opportunities created to invest in renewable energy based mini grids projects in rural areas.

The cost of this alternative senario is estimated at **4,827,270** USD (excluding the PPG preparation and agency fee). The additional cost, in relation to the baseline senario is 4,000,000 USD (including the PPG preparation and excluding

agency fee), will enable direct GHG emission reduction of 5,519 tonnes co2 equavelant and indirect reduction of 471,744 tonnes CO2 equavelant during the 10 years that follow the project end.

G. INDICATE RISKS, INCLUDING CLIMATE CHANGE RISKS, THAT MIGHT PREVENT THE PROJECT OBJECTIVE(S) FROM BEING ACHIEVED AND OUTLINE RISK MANAGEMENT MEASURES:

Seven categories of risks related to the project and its objectives being achieved are considered: i) institutional; ii) technical; iii) market; iv) financial; v) implementation; vi) instability.

Risk	Potential Impact	Probability	Management/Mitigation
Institutional risk: Low government commitment to renewable energy and the GEF UNIDO project The project objectives and activities are in line with national energy policy objectives and actions plans for increasing the energy from renewable energy and helping to enable the market. The Ministry of Mines and Energy is committed to the project and has committing resources to the project. A risk could be that the propose Policies and Financial mechanisms are not enacted.	High	Low	The Ministry of Mines and Energy is fully committed to the project and the objectives are in line with its policies. The Directorate of Energy, the technical arm of the MoE will be responsible for the management and coordination of the project in cooperation with the project steering committee. Close coordination, regular communication and delegation of responsibility will ensure continuous active involvement of key policy/institutional counterparts. It is also important that the enacted laws are followed by application decrees given that the enactment of laws is not sufficient to attract the private sector in rural electrification projects.
Technical risk: The renewable energy based mini-grids technologies are not technically viable There is a technical risk associated with the demonstration projects due to limited experience in the country with the proposed technology and with similar projects. There are no noteworthy technical risks associated with the policy measures and capacity building activities proposed by the UNIDO GEF project. All of them are well proven interventions, tested by national experiences in many other countries.	High	Very Low	Execution of activities will be carried out with the support of international experts/companies with demonstrated and successful past experience. Only mature and proven renewable energy technologies are being proposed. With respect to the capacity building and enabling activities special attention will be given to further defining the existing baseline in order to develop effective on-job-training while establishing the demonstration sites and well-targeted capacity building programmes.

Risk	Potential Impact	Probability	Management/Mitigation
Technical Risk: Operation and maintenance of the mini-grids Given the low literacy rate and lack of specialized capacities among rural communities in Cote d'ivoire, maintenance issues can be considered a risk to the RE based mini-grids.	High	Low-medium	Building technical capacities among rural local authorities and communities is important to mitigate this risk. It is also an integral part of the turn key subcontract of establishing the mini hydro facility. This will be done by providing basic technical training to selected groups and persons, at community and local authority levels, on issues related to operation, preventive and accident resulted maintenance, management of mini grid facility, as well as on the role and responsibility of the various stakeholders and the information and decision flow, etc. This is in addition to the regular training of the operators and maintenance team of the facility.
<u>Economic and Financial risk:</u> Photovoltaic based mini-grids turn out not to be economically and/or financially viable in Cote d'ivoire's rural areas. The risk is that investment in renewable energy projects is shown not to be commercially viable and so demonstration projects are not able to provide replicable examples and impact on the potential market for RE.	High	medium	Focus on renewable energy for productive purposes where the energy generated is used to create values/ services for the communities, which use the income so generated to pay for the energy services received. In addition, photovoltaic technology is known for getting increasingly cost effective and requiring low maintenance .
<u>Economic and Financial risk:</u> Financial and credit constraints prevent enterprises from investing in RE. The ability of companies to invest in renewable energy projects will impact the replication of the demonstration projects and the long term market for renewable energy. Access to finance in Cote d'ivoire is possible but at prohibitively high interest rates.	High	medium	One of the key advantages to investing in renewable energy is the offset of fossil fuel – which is very expensive in Cote d'ivoire. As part of the project training activities life cycle analysis will be taught to show the life time benefits of renewable energy, particularly in a volatile fossil fuel market. Demonstrating these benefits is expected to lead to further investment in RE projects. Training will also be provided to local financial institutions so that they fully understand the risks and benefits of RE projects.
<u>Market risk:</u> Increased investments in renewable energy based mini-grids do not provide high enough returns. Sector stakeholders do not participate/ engage actively in the project Due to the lack of information and awareness in renewable energy there is a risk that there is not active participation from stakeholders. However the project aims to address this barrier and the very high cost of traditional energy in the country means that organizations are looking for alternatives.	High	Low-medium	During the project preparation the general response was of strong support and interest to participate in the project. A well-structured national dissemination campaign demonstrating the viability of the pilot projects and outlining the opportunities during project implementation combined with an active dialogue and involvement of associations at the national and local level during the whole project duration will ensure the desired stakeholder response to the project. In addition, mobilizing part of the investments from development partners which can provide concessionary financing terms, and focus on

Risk	Potential Impact	Probability	Management/Mitigation
			providing energy for productive uses, will contribute market benetration and creation efforts.
Market risk: Fall in fossil fuel prices The international price of oil may fall to a level where fossil fuel power generation will be more cost effective than renewables	High	Very low	Investment in renewable energy should always include assessment of externalities, which will place renewables on a comparative advantage to fossil fuels. The fundamentals of global oil prices indicate that in the long-term the price of oil is expected to grow again.
Implementation risk: UNIDO has long-standing direct experience in the development and implementation of RE projects and it has a strong knowledge of the key variables that determine the success and the failure of project implementation.	Medium	Very low	UNIDO will mitigate this risk through detailed development of activities plans in close cooperation with in-country project partners, stakeholders and developers. Agreed and transparent modus operandi will be defined before the start of the project implementation.
Stability Risk*:* Impact of political environment and instability Although there is a strong political commitment, a volatile political environment could make a come back and lead to potential policy and insecurity environment that may have a detrimental impact on project implementation and on hydropower based mini grids development.	High	Medium	The government commitment to political stability and development is strong indication of the very low probability of the return to volatile situations. The process is supported by the donors and the international community
Climate change risks: Long-term implication of climate change- The largest threat to the project is posed by the drought and its consequences the occurrence of sand storm.	low	Low-Medium	Sand storms could cause the solar PV panels to be covered with dust. This will require more frequent cleaning of the panels to avoid the reduction of its efficiency.

H. EXPLAIN HOW COST-EFFECTIVENESS IS REFLECTED IN THE PROJECT DESIGN:

The project takes a comprehensive approach to address many of the barriers that are preventing the development of the available natural resources into clean modern energy and thus avoiding the use of fossil fuels and reducing GHG emissions. In so doing it will also provide access to energy for basic community needs and economic development.

The barriers are in particular related to awareness and capacity building of public and private stakeholders including relevant institutions, policy makers and potential developers. The strategy of the project to achieve high cost-effectiveness is geared on four principles: (i) creating a critical mass of skilled and knowledgeable technicians and public officers; (ii) through pilot projects, building the awareness of the appropriate technologies and the best practices to combine the intended purposes and maximize the effectiveness; (iii) putting in place policies encouraging the involvement of private sector and providing access to innovative and smart financial mechanisms supporting mini-grid based to renewable energy in rural areas; v) searching and maximizing synergies with ongoing and future programs and credit lines for investment.

Given its focus on addressing policy and technical capacity barriers, the GEF UNIDO project will generate the biggest share of GHG emission savings after the project implementation period, when the capacity built and the programs established will deploy their full impact on market led renewable energy development.

Compared to other conventional energy technology solutions that could be used to provide same energy services, this GEF project is expected to generate cumulative DIRECT GHG emission savings in the range of 5,519 ton CO_{2eq} and INDIRECT GHG emission savings in the range of 27,594 – 471,744 ton CO_{2eq}. The GEF resources cost efficiency for the DIRECT GHG emission savings would be 156.5 USD/ton of CO_{2eq}; for the INDIRECT GHG emission savings cost-efficiency would significantly improve, going down to 31.3 – 1.8 USD/ton CO_{2eq}. These figures are high due to the costly nature of the photovoltaic technology and the local conditions in which the system has to be installed and operate.

PART III: INSTITUTIONAL COORDINATION AND SUPPORT

A. INSTITUTIONAL ARRANGEMENT:

UNIDO is the sole implementing GEF agency of this project. However, as discussed in section E, the project will collaborate with other international donor community at a national level, and with the GEF Agencies implementing the GEF Strategic Program for West Africa at the regional level.

B. PROJECT IMPLEMENTATION ARRANGEMENT:

As GEF Implementing Agency, UNIDO holds the ultimate responsibility for the implementation of the project, the delivery of the planned outputs and the achievement of the expected outcomes. The project will be executed under the technical and administrative supervision of UNIDO's project manager, following UNIDO's rule and procedures.

The project will be implemented in collaboration with the Directorate of Energy of the Ministry of Mines and Energy. The Ministry is the main counterpart agency by virtue of its central role in rural energy in coordinating all the activities related to rural energy, and taking part in improving the energy access.

UNIDO will be responsible for the general oversight of the project management conducted by the PCU and for the monitoring of the project, and reporting on the project performance to the GEF. UNIDO will be in charge of procuring the international expertise needed to deliver the outputs planned. It will manage, supervise and monitor the work of the international teams and ensure that deliverables are technically sound and consistent with the requirements of the project.

On a national level, a Project Coordination Unit (PCU) will be established within the Directorate of Energy of the Ministry of Mines and Energy. This unit will be constituted by a National Project Coordinator (NPC), and administrative support (Secretary-finance Clerk). The PCU will be responsible for overall day to day coordination and supervision of field activities, including effective linkages between the project and the beneficiaries and other on-going programs, ensuring an effective monitoring and evaluation system of all activities as per agreed project work plan. The PMU will coordinate all project activities being carried out by project national experts and partners. It will also be in charge of the organization of the various seminars and trainings to be carried out under the Project

Taking into consideration the nature of this project – involving activities dealing with different counterparts (Ministries, local government bodies and other institutions) and cooperation with all concerned parties – a Project Steering Committee (PSC) will be constituted by representatives of main stakeholders. The main functions and responsibilities of the PSC will be to (1) advise the project on strategic directions of support activities to be provided; (2) ensure the effective cooperation between all involved stakeholders; and (3) advise the effectiveness of the ongoing activities, including the progress towards achieving the planned outputs, review and approve annual work plan. In this connection, the project will achieve coordination and cooperation among stakeholders and will ensure national ownership and sustainability of the project planned activities. The members of the PSC will be representatives from the following institutions: Ministry of Mines and Energy, Minister of Environment/ GEF focal point as Chair, Ministry of Finance and Economy, UNIDO Representative, and the Project National Coordinator. The PSC members will hold bi-annual meetings or more frequently if the situation requires. The Project Coordinating Unit (PCU) will act as the secretariat.

The project strategy pays particular attention to the involvement of the communities to be served by the mini grids in decision making, planning and monitoring through participatory workshops. In this respect, the project will support the representatives of the communities through extensive participatory methodologies to assure their maximum involvement and enhance their awareness of project opportunities.

Whenever possible the business associations (cooperatives), specifically for women, will be established specifically for management, operation and maintenance and productive uses of the energy produced. In the associations where men and women are members, women will be encouraged and supported to be in the management level. To increase the number of women in the associations, all efforts will be made not to overburden them by work (additional household work) a flexible working time.

Close cooperation will be sought with various government departments, multi/bilateral donor agencies and civil society to assure complementarily of work to bring about synergies between various ongoing or proposed interventions.

At the beginning of project implementation a detailed working plan for the entire duration of the project will be developed by UNIDO in collaboration with the PCU, the Ministry of Mines and Energy and the national and international teams of experts. The working plan will clearly define roles and responsibilities for the execution of project activities, including monitoring and evaluation; it will set milestones for deliverables and outputs. The working plan will be used as management and monitoring tool by UNIDO and the PCU and reviewed and updated as appropriate on a biannual basis. Figure 6 shows a diagram of the project implementation arrangement.

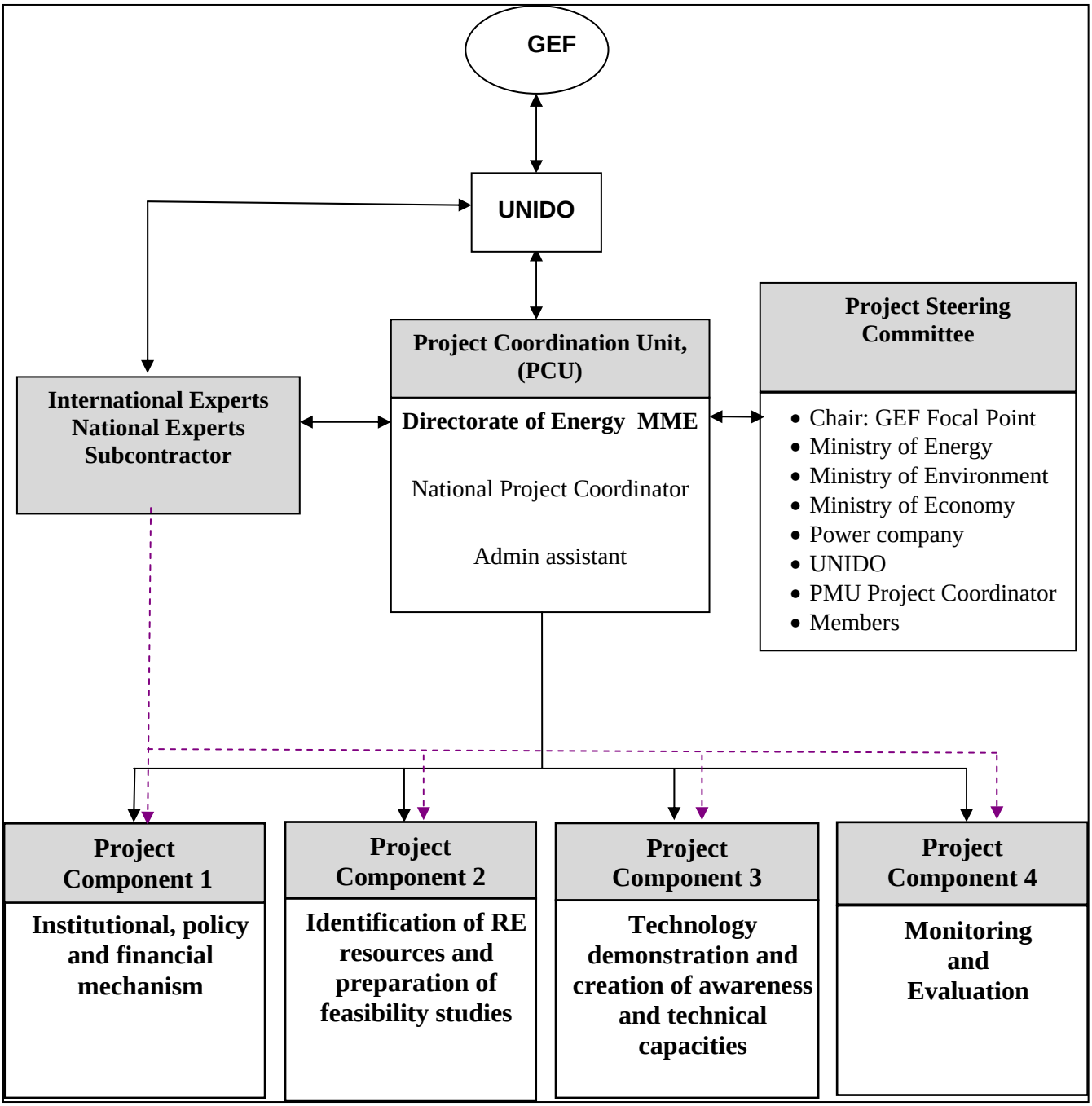

Fig.6 Diagram of project implementation arrangement

PART IV: EXPLAIN THE ALIGNMENT OF PROJECT DESIGN WITH THE ORIGINAL PIF:

Overall Comments

No major changes have been made to the basic project design in comparison with the original PIF, except the re-wording of the text of the Project Framework, while keeping the intended project design in terms of expected outcomes and expected outputs.

However due to the political instability in the country experienced for a number of years and aggravated lately, before being settled, the co-financing resources envisaged at the PIF stage have been only partially raised. Consequently, budget related to the various project components have been re-calculated and down sized to enable achieving the intended original designed results within the budget constrains.

These changes are mainly the following:

i) Re-wording of the text of the Project Framework, while keeping the intended project design in terms of Project activities, expected outcomes and expected outputs.

ii) On the level of expected outputs, particularly regarding the energy sources of pilot demonstration mini grids, the activities undertaken during the PPG phase indicated the preference of the government to focus on solar photovoltaic technologies and to leave out the waste-to- energy pathway, due to the existence of planned activities covering the latter. Therefore, solar photovoltaic is considered for this project with its huge potentials for replication, and thus high post project impacts on emissions reduction. In addition, given the maturity and the reliability of the photovoltaic technology, as well as the low /no maintenance needs, it is considered more appropriate for energy access in the peri urban and rural areas of Cote d'Ivoire. Consequently, photovoltaic based mini grids are to be established as pilot demonstration projects. Although the costs of mitigating on per ton of CO2eq using photovoltaic technology is significantly higher in comparison with other renewable energy technology, the global photovoltaic technology trend is increasingly showing a falling costs, a fact that will contribute to making the investment in photovoltaic based mini grids an attractive option for the private sector. At implementation, this project will seek to establish synergetic relationships with other projects seeking to increase access to energy in rural areas by use of renewables. As part of the normal project monitoring, such information will be brought to the PMO and SC and a determination will be made on how best create symbiotic relationships. At the time of finalization of CEO endorsement, these activities were still at preparatory activities and hence the difficulty in determining the possible collaboration opportunities. This project, once approved, will be actively communicated to other initiatives.

iii) Component 1 is down sized by reducing the extent and intensity of activities: main Outputs became regulations and policies reviewed and recommendations formulated and discussed with the stakeholders.

iv) Component 2 is recalculated and downsized by reducing the extent and the intensity of activities: the main outputs is a portfolio of renewable energy project sites identified for replication and private sector investments.

v) Component 3 is recalculated and its budget increased to enable seven photovoltaic based mini grids to be established as pilot demonstration projects for the demonstration of the technical and economic feasibility as well as for the learning by doing approach to capacity and awareness building.

Specific Comments in the Review Sheet

vi) Point 9 – see explanation above on project scope. And collaboration with other initiatives. Timeframe for components 1.1 and 1.4 were adjusted. Components 2 will only conduct pre-feasibility studies while

component 3 will do the detailed feasibility studies for the selected pilot projects. Ministry of Mines and Energy will now conduct the feasibility in component 3

vii) Point 11 – further explanation provided on the coordination between this project and the GIZ and HVA initiatives.

viii) Point 14 – More co-financing has now been mobilized, almost 3.8 million US$

ix) Point 19 – Explanation provided on the need to hire an administrative assistant in the project and hence the PM costs reaching 6.1 %. Once approved, the project will engage the Ministry of Mines and Energy in discussions with a view to reduce the PM costs by getting a secondment etc or some other arrangements.

x) Point 20 – Table E and Annex C corrected. Explanation provided in text on project document and more detailed provided in Annex C on the use of GEF resources.

xi) Point 22 – Co-financing letters provided. Additional co-financing had been committed and cost breakdown provided in Annex C.

xii) Point 23 tracking tool revisited

xiii) Point 24 – Clarification provided on page 4

PART V: AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF policies and procedures and meets the GEF criteria for CEO Endorsement.

Agency coordinator, Agency name	Signature	Date (Month, day, year)	Project Contact Person	Telephone	Email Adress
Mr. Dmitri PISKOUNOV, Managing Director, Programme Development and Technical Cooperation Division, UNIDO			Ms. Fatin ALI MOHAMED Industrial Development Officer, Renewable and Rural Energy Unit Energy and Climate Change Branch PTC Division, UNIDO	+43-1-26026-3279	f.alimohamed@unido.org

ANNEX A: PROJECT RESULTS FRAMEWORK

Outcomes	Indicators	Baseline	Target	Sources of verification	Risks and assumptions
Objective					
Component 1. Institutional, policy and financial mechanisms					
An effective, market-oriented policy and regulatory framework to stimulate investments in RE.	1. Number of RE policy programs developed and validated 2. Adoption of regulatory measures to support RE and market transformation 3. Photovoltaic mini grid systems information and dissemination seminars, education and outreach materials available 4. Energy Institutional framework effective and role of main actors in promoting a RE market defined. 5. Local financial service providers aware and have expertise of analysis and evaluation of risks related to investments on renewable energies. 5. Public-private partnership conceived and promoted.	1. Weak institutional support 2- Lack of effective institutional framework and no specific regulations to support RE is in place. 3. Local financial service and Lack information and technical capacity related to RE investment. 4. Week private sector involvement in RE energy based electrification	1. 3 seminars delivered. 2. Around 10 policy makers and other stakeholders trained. 3. 10 financial institutions' staff trained. 4. The awareness and technical capacity built of 10 of private sector actors. 5. Best Practice publications. 6. Case studies developed. 7. PPP financial mechanism conceived and ready for practical validation 8. Outreach materials.	1. Monitoring reports and site visits 2. End of project survey 3. Mid term and final evaluation	A1. Sustained and solid Government support to the project. A2. Poverty reduction and economic growth drives for securing the modern energy input to development grow progressively stronger.
Component 2. Identification of RE resources and preparation of feasibility studies					

Outcomes	Indicators	Baseline	Target	Sources of verification	Risks and assumptions
A portfolio of RE energy projects prepared for pilot PPP investments during and post GEF- project promoting PPP and productive uses	1. Project sites identified and its end-use evaluated. 2. A portfolio of viable and bankable projects for the installation of PV mini grids by private investors following PPP a pre-defined set of criteria.	1. No reliable information available on viable RE projects.	1. A portfolio of additional 10 viable PV mini grid projects At least 7 private developers and investors interested in establishing and or managing, and consequently, one or two private-public sector based PV mini grids; materialized during the GEF project and the remaining take place after its completion.	1. Monitoring reports and site visits. 2. End of project survey. 3. Mid term and final evaluation.	A1. Counterpart coordinates and executes the project efficiently and effectively A2. General security and stability in the country. A3. Security and stability in the country
Component 3- Technology demonstration and creation of awareness and technical capacities					

ANNEX B: RESPONSES TO PROJECT REVIEWS

ANNEX C: CONSULTANTS TO BE HIRED FOR THE PROJECT USING GEF RESOURCES

Position Titles	*$/ person week**	*Estimated person weeks***	*Tasks to be performed*
For Project Management			
Local			
National project Coordinator	698	53.3	Responsible for the management, monitoring, coordination of all project activities in the countries. Responsible of ensuring, in close cooperation with the relevant authorities, all needed authorizations and permits are timely obtained (environmental, construction, long period visa, clearance of equipment, etc.) Organizing all needed contacts with local authorities. Responsible of monitoring the construction activities. Responsible for the organization of project activities, such as the organization of the training sessions and workshops. Facilitating the work of the other national and international experts. Tracking and timely disbursement of project funds. One third of full-time assignment for the entire duration of the project, 3.0 yr 1 week= 5 working days; 1 months= 4.3 weeks;
Project administrative assistance	300	53.41	Administrative assistance One third of full -time assignment for the entire duration of the project, 3.0 yr 1 week= 5 working days; 1 months= 4.3 weeks;
International			
-	-	-	-
Justification for Travel, if any: Justification for Travel, if any: The travel budget, 8000 USD from the co-finance, is to cover visits to project sites and liaisons with project partners.			
For Technical Assistance			
Local			
Experts for establishing the PV based mini grids. Video production, web design, local awareness building on operation and maintenance, and management issues	698	4	In cooperation with the contractor, the experts will facilitate site identification and pre-feasibility studies preparation, promote productive use, impact assessment, facilitate contacts with the local population, awareness building of the beneficiaries, etc.
Experts for energy policies and legislations, financial mechanisms, institutional framework	698	6	In collaboration with the international experts, these experts will develop policies recommendations and guidelines to promote market led PV development and the involvement of the private sector. Participate in the organization and be a resources persons for the training and awareness building seminars.

Experts for validation and dissemination of lessons learned	698	8.6	In cooperation with the contractor and project coordinator the consultants to carry out follow ups and validation of the project outputs and dissemination of lessons learned.
International			
Experts for energy policies and legislations, financial mechanisms, institutional framework	3000	2	The experts will develop policies recommendations and guidelines to promote market led PV development and the involvement of the private sector.
Experts for monitoring, validation through out the process of establishing the PV based isolated grids	3000	3	The experts will validate designs and specifications, supervise and test the quality of construction, etc.
Experts for energy policies and legislations, financial mechanisms, institutional framework	3000	3	The experts will develop policies recommendations and guidelines to promote market led mini hydro development and the involvement of the private sector.
Justification for Travel, if any: -			
Contracted services			
	Budget $	***Estimated person weeks*****	***Tasks to be performed***
Foreign company to deliver international technical assistance needed for all outputs of PC3 (and part of PC2)	752,464	n/a	The amount of USD 752,464 from GEF resources in addition to USD 3.727,000 from co-finance are the estimated value of the contract for establishing five PV based mini grids totaling 350 kW of capacity. The contractor will design, construct, install electro-mechanics equipment and transmission and distribution lines and provides the technical expertise and on-job training and guidance of national experts and DoE staff for the development and establishment of the mini grids.

* Provide dollar rate per person week. ** Total person weeks needed to carry out the tasks.

ANNEX D: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS

A. EXPLAIN IF THE PPG OBJECTIVE HAS BEEN ACHIEVED THROUGH THE PPG ACTIVITIES UNDERTAKEN.

PPG objectives have been fully achieved:

1. Collection of supplemental data: Missions to several potential sites were carried out. These missions helped in gathering pre-feasibility data that are key for the future development and success of the project, such as existing infrastructure in the rural communities, number of families, average size of families, distance to the nearest grid, distance to the farthest household, first source of revenue, average household income, sources of energy for lighting, radio and TV and their cost, industry and agriculture sectors and small businesses in the area, length of the rainy season and daily irradiation hours, etc.
2. Stakeholder consultations: During the same missions, the team held meetings with the representatives of the decentralized bodies, village chiefs, educators and health personnel, family heads and managers of basic infrastructure in each village visited. These meetings helped explain the details of the project to the different stakeholders and beneficiaries assuring their ownership and participation in the project.
3. Design of pilot projects: Co-financing resources envisaged at the PIF stage have been raised; Government co-finance ($800,000 US) is confirmed. The West Africa development bank has since committed USD 3,000,000 to the project.
4. Full project formulation:
    a. The project document has been formulated on the basis of further analysis of the policy, legal and regulatory frameworks, capacity building needs assessment and stakeholders consultations
    b. Direct and indirect energy savings and GHG emission reduction have been estimated on the basis of the identified solar irradiation rates.

Figure 5. Survey in Sikolo.

Figure 6. School in Sokouraba.

B. DESCRIBE FINDINGS THAT MIGHT AFFECT THE PROJECT DESIGN OR ANY CONCERNS ON PROJECT IMPLEMENTATION, IF ANY:

Findings that might affect project design

During the mission on June 18-30, 2010, the team pointed out the bad condition of the roads joining Bouna-Niamoué, Bouna-Ferké, Ferké-Sikolo, Madinani-Séguélon, which could cause logistic delays during the implementation given that some equipment and materials are not locally available. Thus, this should be taken into account when preparing schedules.

A second concern was that the village inhabitants had not been informed in advance about the project plans. Thanks to this mission, now all village chiefs and main stakeholders and beneficiaries are aware of the project and their opinions and comments have been taken into account.

Any concerns on project implementation

No additional concern beside the risks discussed in PART II, SECTION G.

C. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES AND THEIR IMPLEMENTATION STATUS IN THE TABLE BELOW:

Project Preparation Activities Approved	*Implementation Status*	*GEF Amount ($)*				*Co-financing ($)*
		Amount Approved	*Amount Spent*	*Amount Committed*	*Uncommitted Amount**	
Collection of supplemental data	Completed	9,000	9,000			14,000
Stakeholder consultation	Completed	6,000	6,000		0	16,000
Design of pilot/demonstration projects	Completed	23,000	23,000		0	15,000
Project strategy and implementation detailing	Completed	12,000	11596	404	0	5,000
TOTAL		50,000	49,596	404.	0	50,000

* Any uncommitted amounts should be returned to the GEF Trust Fund. This is not a physical transfer of money, but achieved through reporting and netting out from disbursement request to Trustee. Please indicate expected date of refund transaction to Trustee.

ANNEX D: CALENDAR OF EXPECTED REFLOWS

N/A. The proposed project does not include a non-grant instrument.

ANNEX E: CO-FINANCING LETTERS

POINT FOCAL OPERATIONNEL
DU FONDS POUR L'ENVIRONNEMENT
MONDIAL (PFO/FEM)

REPUBLIQUE DE COTE D'IVOIRE
Union - Discipline - Travail

April 15th, 2009

To: **Ms Monique Barbut**
CEO and Chairperson
GEF
1818 H Street, NW
Washington, D.C. 20433
USA

Subject : **Endorsement for 'Promoting Renewable Energy-based Grids in Rural Communities for Productive uses in Côte d'Ivoire'.**

In my capacity as GEF Operational Focal Point for Cote d'Ivoire I confirm that the above project proposal (a) is in accordance with the government's national priorities and the commitments made by Cote d'Ivoire under the relevant global environmental conventions and (b) has been discussed with relevant stakeholders, including the global environmental convention focal points, in accordance with GEF's policy on public involvement.

Accordingly, I am pleased to endorse the preparation of the above project proposal with the support of UNIDO. If approved, the proposal will be prepared and implemented by Ministry of Mines and Energy of Côte d'Ivoire. Further, I request UNIDO to provide a copy of the project document for information before it is submitted to the GEF Secretariat for CEO endorsement.

I understand that the total GEF financing being requested for this project is $ 1 million, inclusive of project preparation grant (PPG), if any, and a 10% Agency fee to UNIDO for project cycle management services associated with this project.

I confirm the Government commitment for co-financing the project with 800,000 USD in cash.

I consent to the utilization of the following indicative allocations available to Côte d'Ivoire in GEF-4 under the GEF Resource Allocation Framework to cover the GEF project preparation and implementation as well as the associated Agency fees for this project.

Climate Change : $ 1 million

Sincerely,

Copy to:
- *Minister of Environment, Waters and Forests*
  GEF Political Focal Point
- *Minister of Mines and Energy*
- *CEO of National Investment Bank*
- *Mr. Dmitri Piskounov, Managing Director, Programme Development and Technical Cooperation Division (UNIDO)*
- *Convention Focal Point for UNFCCC*

POINT FOCAL OPERATIONNEL

Mrs KONE-BAKAYOKO Alimata
GEF Operational Focal Point

Immeuble SCIAM 12ème étage, porte 27 Tél : (225) 20-20-98-30/29 Fax : (225) 20-21-55-53

BOAD

BANQUE OUEST AFRICAINE DE DÉVELOPPEMENT

Lome, 08 NOV 2011 /PRESID/2011 N° 1460

Mr. Dimitri Piskounov
Managing Director,
Programme Development and
Technical Cooperation Division,
UNIDO
Vienna International Centre.
P.O. Box 300,
1400 Vienna,
AUTRIA

Subject : Letter of interest to co-finance solar photovoltaic based mini grids in Ivory Coast

Dear Mr. Piskounov,

Reference is made to the document and studies received on the GEF projet no. 4005 «Promoting renewable energy based grids in rural communities for productive uses in Ivory Coast». The « banque Ouest Africaine de Développement (BOAD) », wishes to express its intent to co-finance the establishment of 5 solar photovoltaic mini with USD 3 Millions in sites identified by the government of Ivory Coast.

The conditions for co-financing will be discussed with stakeholders

Yours sincerely,

Christian Adovelande
Chairman of BOAD

68 av de la Libération, BP 1172 Lomé, Togo • Tél. : +228 221 59 06 • Fax : +228 221 52 67 • www.boad.org

ANNEX F: REPUBLIC OF IVORY COST: OFF GRID RENEWABLE ELECTRIFICATION PROJECT

PRE FEASIBILITY REPORT

INTRODUCTION

Overview

In any country irrespective of the status of development, reliable and affordable energy services are essential for economic growth and social development. Currently, as many as 25 African countries are faced with power and/or fuel shortages, causing severe economic disruption. Government action is essential to secure reliable supplies and services without adversely impacting on public finances.

The Investment Climate Assessments (based on a survey of manufacturing firms in 22 Sub-Saharan African countries) show that 40% of firms identify unreliable power supply as a major constraint to doing business. On average they experience 36 days of power outages per year and suffer losses of more than 6% of sales revenue as a result of lost production and damaged equipment. Firms running their own generators pay on average around US$0.40 per kilowatt-hour for electricity, or about four times as much as they would typically pay for electricity from the public grid.[12]

Ivory Coast

Republic de Cote d'Ivoire (Republic of Ivory Coast) is located in Western Africa, bordering the North Atlantic Ocean, between Ghana and Liberia, in the time zone GMT 0. The country has boundaries of 3,110 - Burkina Faso 584, Ghana 668, Guinea 610, Liberia 716, Mali 532 (km), and a coastline of 515 (km). Major urban areas: Yamoussoukro, Abidjan, Bouake, Dalowqaqqqa, Gagnoa, Man.

Côte d'Ivoire has for the region a relatively high income per capita (USD 960 in 2007) and plays a key role in transit trade for neighboring landlocked countries. The country is the world's largest exporter of cocoa, and the fourth largest exporter of goods in sub-Saharan Africa (following South Africa, Nigeria and Angola).[13]

Climate of Ivory Coast is Tropical along coast and semiarid in far north and particularly with three seasons - warm and dry (November to March), hot and dry (March to May), hot and wet (June to October). Natural Resources available in the country are Petroleum, natural gas, diamonds, manganese, iron ore, cobalt, bauxite, copper, gold, nickel, tantalum, silica sand, clay, cocoa beans, coffee, palm oil, and hydropower.[14]

Rural areas of Ivory Cost, most of which were not serviced by electricity, wood, in both its natural state and as charcoal, and kerosene were the most important source of household energy.

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[12] EU Energy Initiative Partnership Dialogue Facility (EUEI PDF); ***Energy and National Finances in Africa: A Background Paper*** *; Financing For Development Conference, Accra, 30 - 31 May 2007, pg2*

[13] http://en.wikipedia.org/wiki/C%C3%B4te_d'Ivoire#Economy
[14] http://www.intute.ac.uk/worldguide/html/921_map.html#data

FIGURE 7: MAP OF IVORY COST

Electricity Sector

Electricity provides welfare to the people and is a key asset for competitiveness and development of Côte d'Ivoire. In the late 1980s, electrical production in Côte d'Ivoire surpassed that of most other countries in sub-Saharan Africa. Its hydroelectric stations and the large thermal station at Vridi provided electricity for the central and southern portions of the country, where most industrial activity took place.[15]

The country has taken advantage of rivers for the production of electrical energy, which is ensured by six hydroelectric dams (1 Ayame, Ayame 2, Kossou Taabo, Buyo and Faye) and three thermal power plants (Vridi 1, and CIPREL AZITO).

Production capacity is based on a total installed capacity of 1200 MW including 600 MW for hydro and 600 MW for thermal plants. In 2007, total production of electricity was 5513 GWh, 1 796.7 GWh from hydropower is 32.6% and 3 716.5 GWh of thermal origin or 67.4%. The electricity is sent through an electrical network composed of 4,402 km of line including a high voltage electrical 885.5 km 225 kV line and 2 516.5 km of 90 kV line. For distribution, it is based on 18,304 km of medium voltage line 15/33 kV and 15 162 km of low voltage 220/380V.

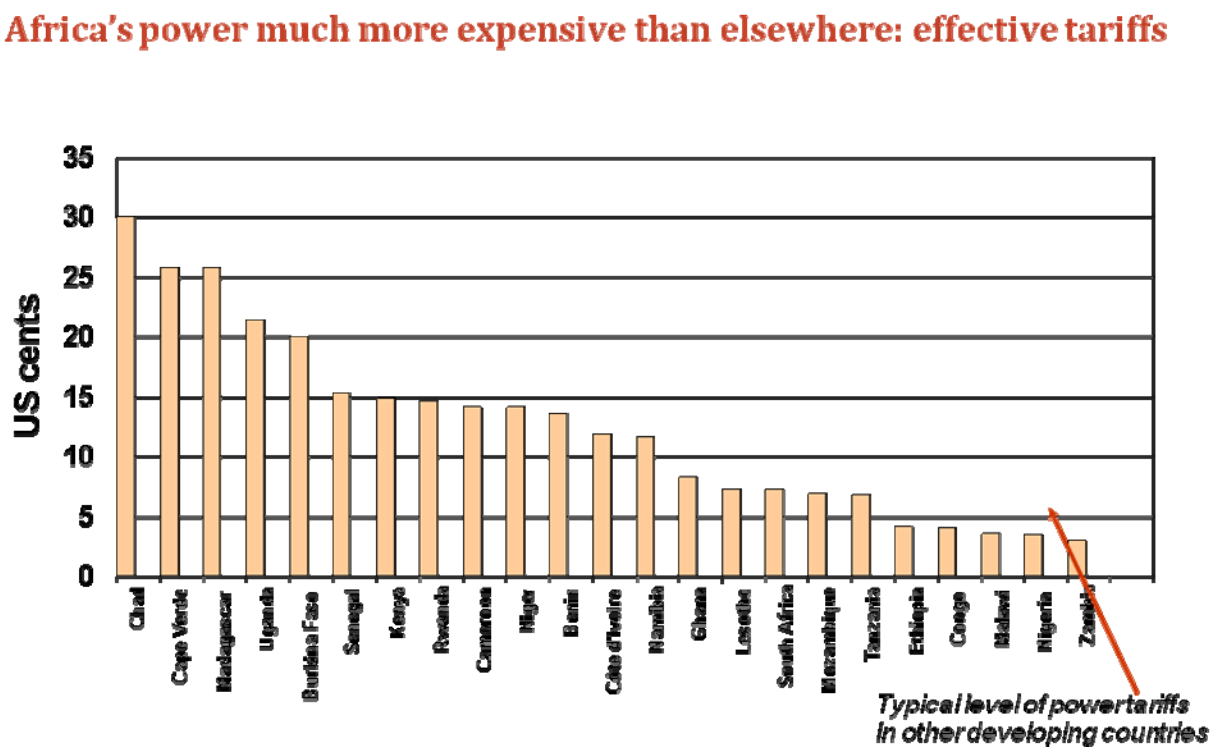
For now and since 1994, the surplus electricity production is exported through an interconnection of national electricity grid with that of countries in the sub region are: Benin, Burkina Faso, Ghana, Mali and Togo. Thus the energy exported in 2007 was about 772.49 GWh.

In terms of access to energy services, the record indicates that biomass represents about 70% of the sources of energy needs of the country. The rate of electricity penetration (number of electrified villages by the total number of localities in Cote d'Ivoire) is currently 31%. The population living in a city electrified represents 71% of the total population; say that if everyone had the opportunity to connect, the access rate to electricity is very high. But this rate is very low in rural and suburban area where a significant proportion of the population is involved in sub leasing of electricity, with risks of all kinds. The number of households with a subscription to electricity compared to the total number of households is less than

[15] http://www.country-data.com/cgi-bin/query/r-6974.html

20%. Similarly, basic social services like health, education or human services hydraulic lack access to electricity in electrified villages yet. Meanwhile, electricity rates were not adjusted between 2001 and 2008.[16]

FIGURE 8



Source: **Ten Things Journalists Need to Know about Africa's Energy Sector**; AICD Africa Infrastructure Country Diagnostic; PPT

Based on the above graph, tariff of electricity for domestic users in Cote d'lvoltre is moderate value amongst African nations but higher than the tariff available in most developing countries in the world.

Objective

Objective of this pilot renewable electrification project is to create awareness among various stakeholders about the prospect of improving living standards of off grid rural communities by providing reliable electricity supply for basic needs by means of solar and hydro energy available in plenty in the country.

Target Group

Target groups of this project are average households and small and medium industries which do not have access to electricity especially in rural and sub urban areas; in addition to the private sector interested in investing in rural electrification in partnership with the public sector.

[16] Strategie de Relance du Developpement et de Reduction de la Pauvrete (DSRP); January 2009

Load Type

It is assumed that the load charactestics of the selected beneficiaries are mainly small resistive and inductive loads like CFL Bulbs, TVs, motors and Radios etc. In addition to water pumps and small equipment used in cottage industries, public buildings and clinics, such as welding and basic wood processing machines, refrigerators, and deep freezers.

TABLE 1: CONSUMER LOADS PER HIGH INCOME HOUSE

No	Load	Wattage (W)	Number of Units	Usage (Hours/day)	Remarks
1	CFL Lights – Kitchen	11	1	6	5pm -11pm
2	CFL Light - Living room	11	3	8	5pm -1am
3	CFL Light - Room	11	1	4	5pm – 9pm
4	Fridge	200	1	8	1pm -9pm
5	TV (Colour)	200	1	4	6pm – 10pm
6	Cell phone charging	20	1	2	8am – 9am 8pm – 9pm
7	Ventilo/ Fan	60	1	8	8am – 4pm
	TOTAL	**513**		**3184 Whr**	
	Number of Houses	425			

Note:

1. Total Watt Hours per day/HIGH income house is 3,184.
2. It is assumed there are 125 of houses as HIGH Income; 150 is MEDIUM income (with usage of 1170 Watt hours/day) and 150 is LOW income with usage of 238 Whr/day
3. Total Watt Hours per day/ 425 houses is **609,200**. (i.e.609.2 kWhr)
4. No electric cooking and water heating allowed
5. Each house must have proper wiring including RCD, MCBs and earthing.

TABLE 2 : INDUSTRIAL, SOCIAL AND STREET LIGHTING[17]

No	Load	Wattage (W)	Number of Units	Usage (Hours/day)	Remarks
1	CFL street Light	11	60	12	5pm -5am
2	Health Center	5,000	1	6	
3	Pump station	5,000	1	8	
4	Schools	3,000	8	6	
5	Mosque/ Church	3,000	8	4	
	TOTAL				

Note:

1. Total Watt Hours per day for street lighting is 7,920.
2. Total Watt Hours per day for Health center is 30,000.
3. Total Watt Hours per day for Pump station is 344,000.
4. Total Watt Hours per day for Schools is 144,000.
5. Total Watt Hours per day for Mosques/ Churches is 96,000.
6. Total Watt Hours per day for Industrial, Social and Street lights is **621,920**.

[17] Selection of Industrial and Social Loads needs thorough analysis considering important criteria for solar PV system. This is only example. Table 6 in Annexure 3 gives overview of possible available loads different sites.

Daily Load Profile

Daily Load Profile for a village for 425 houses (includes HIGH, MEDIUM and LOW income houses) and all the Social, Public and Industrial loads are graphed in Annexure4.

It is not practical to connect all the houses and loads due to technical and economical reasons. Hence with considering suitable selection criteria; loads that can be connected to the mini grid have to be selected carefully.

<u>Solar PV Technology</u>

Technology Provenances

Solar photovoltaic system is one of **renewable energy system** which uses PV modules to convert sunlight into electricity. The electricity generated can be stored or used directly, fed back into grid line or combined with one or more other electricity generators or more renewable energy source. Solar PV system is very reliable and clean source of electricity that can suit a wide range of applications such as residence, industry, agriculture, livestock, etc.

The efficiency (the ratio of the maximum power output and the incident radiation flux) of the best single-junction silicon solar cells has now reached 24% in laboratory test conditions. The best silicon commercially available PV modules have an efficiency of about 20%. (SunPower 315:19.3% @ standard conditions)[18]

Potential

Republic of Ivory Coast positioned just above the. The climate of the country is arid which encourage of use of solar energy systems. As per the solar radiation intensity graph in the figure below, Republic of Ivory Coast has solar intensity above 4- 5 kJ/m^2 . Hence solar potential is quite attractive through ought country.

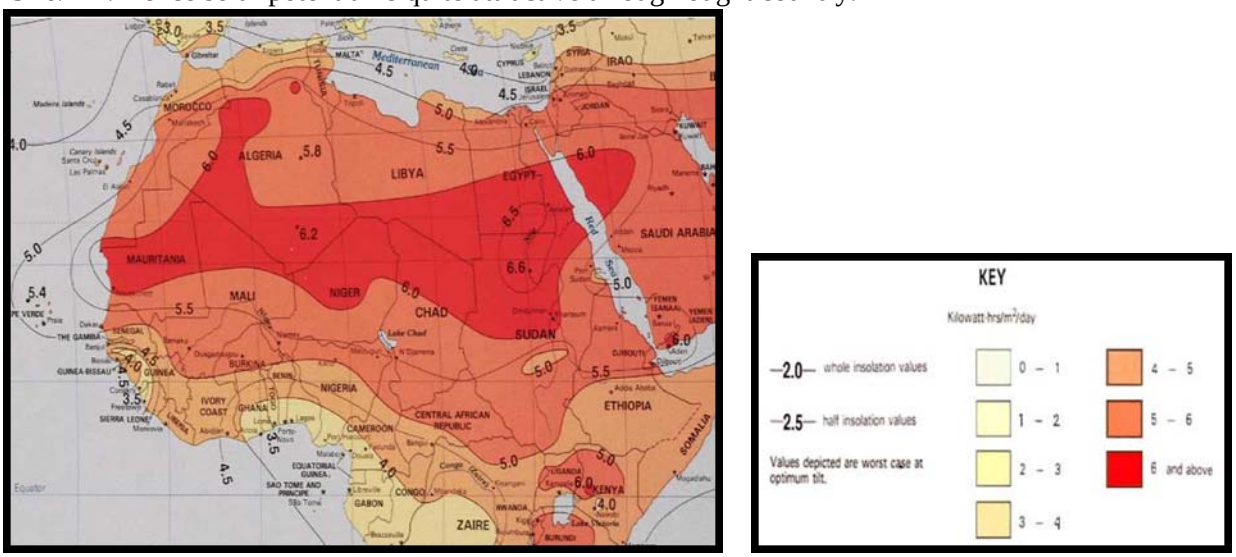


FIGURE 9: SOLAR INTENSITY GRAPH OF AFRICA

[18]Krothapalli Anjane, Solar Energy: An Introduction, Energy & Sustainability Center, September, 2010, slide no 6

Cost Factor

The solar industry is looking to drive module prices down to $1.50 - 2.00 per watt over the next decade, if it is to make large inroads in to the grid tied electricity market, without subsidy. Factory gate prices have now already reached this level, but retail price are still considerably higher (Annexure 2).

System

System Components

Solar PV system includes different components that should be selected according to the system type, site location and applications. The major components for solar PV system are solar charge controller, inverter, battery bank and loads or end users.

In the proposed system, generation will be centralized and mini grid will be setup to distribute the AC power to load centers mainly the rural households who are assumed to be located scattered around few centers.

- **PV module** – converts sunlight into DC electricity.
- **Solar charge controller** – regulates the voltage and current coming from the PV panels going to battery and prevents battery overcharging and prolongs the battery life.
- **Inverter** – converts DC output of PV panels into a clean AC current for AC appliances or fed back into grid line.
- **Battery** – stores energy for supplying to electrical appliances when there is a demand. Depends on the solar radiation and autonomy.
- **Load** – is electrical appliances that connected to solar PV system such as lights, TV, computer , Fridges, Welding plants, Water pumps and Mills etc.
- Mounting structures
- House wiring electrical components including bulbs and fixtures

Based on the reliability of the system required, there can be other energy source which may generate power combine or in an emergency situations. For example, health centers/ vaccination centers located far remote places needs auxiliary energy source either renewable or conventional to meet the demand conditions satisfactorily.

- **Auxiliary energy sources** - is diesel generator or other renewable energy sources.

Solar PV system usually has the panel capacity ranging from 30 Wp to 200 Wp in off grid systems. In the proposed system for Ivory coast rural village, there will be central solar generation system which charges batteries during daytime where the household load is minimum. The distributed electricity will be AC supply and hence an inverter will be introduced to the system below.

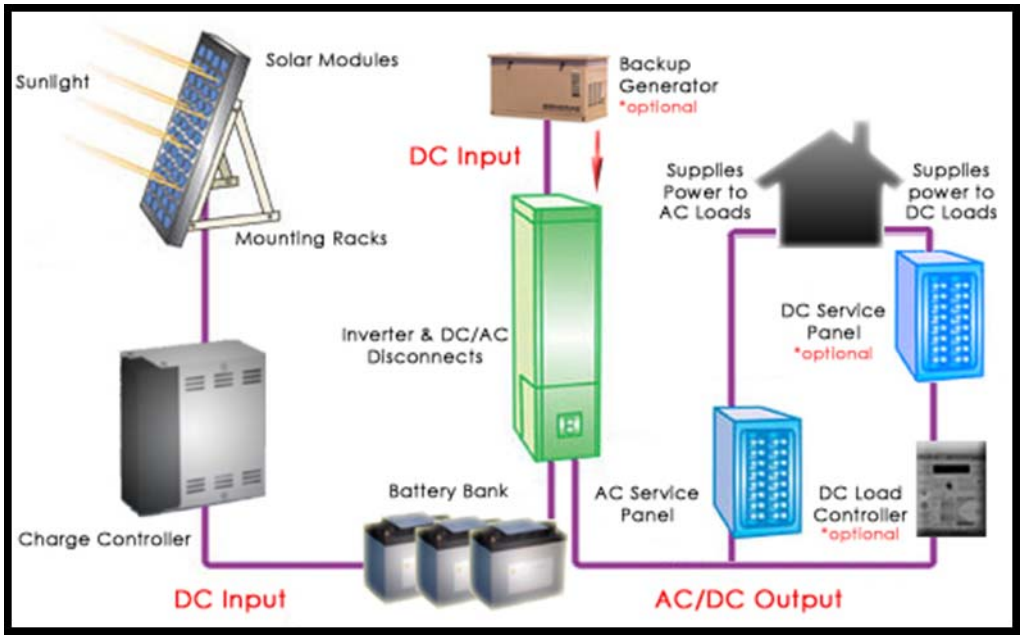


FIGURE 10: OFF GRID SOLAR SYSTEM

Source: www.aessolarenergy.com/off_grid_system.htm

Calculations

Following calculations were made for a village for the Domestic and Social loads selected in Table 2 and Industrial Loads selected in Table 3.

Calculate the total Watt-peak rating needed for PV modules

Total Watt-peak rating needed for the PV panels $= \frac{\text{Total Watt-hours per day needed from the PV}}{\text{Panel generation factor}}$[19]

$= (1{,}231{,}120/3.43)$

$= \underline{358{,}927 \text{ Wp}}$

Number of PV panels for the system

Number of PV panels $= \frac{\text{Total Watt-peak rating needed}}{\text{Rated output Watt-peak of the PV modules available}}$

$= (358{,}927/ 180) = \underline{1{,}994}$

Inverter sizing

For standalone systems, the inverter must be large enough to handle the total Watts that will be using at a time[20]. According to the daily load pattern, it is happening between 8pm to 9pm and the value is 145 kW. (with three lamps, TV, Fridge in houses and pump in the industrial applications)

-Hence capacity of inverter = 145 kW
- Input Voltage of = batter bank voltage
- Output voltage = 230 V

Battery Bank Sizing

The deep cycle battery bank should be large enough to store sufficient energy to operate the appliances at night and cloudy days (days of autonomy).

[19] Depends on the location and 3.43 is for Chad Republic

[20] As motors are used, the capacity of inverter must be at least three times of the motor.

$$\text{Battery Capacity (Ah)} = \frac{\text{Total Watt-hours per day used by appliances}}{(0.85 \times 0.6 \times \text{nominal battery voltage})} \times \text{Days of autonomy}$$

Note: Battery loss factor is 0.85 and depth of discharge factor is 0.6.
Let's take battery bank voltage is 108V and days of autonomy as 2.
Battery Capacity (Ah) = 1,231,120*2/(0.85*0.6*108) = 44,703 Ah

With 12v 100AH battery it required 12x447 no. of batteries.

Solar charge controller sizing
The solar charge controller is typically rated against Amperage and Voltage capacities. It requires to make sure that solar charge controller has enough capacity to handle the current from PV array.

According to standard practice, the sizing of solar charge controller is to take the short circuit current (Isc) of the PV array, and multiply it by 1.3

Solar charge controller rating = Total short circuit current of PV array x 1.3
= (4.9 * 6) * 1.3 = 38.2 A

Nine panels in series should be connected to get 108V. As 180 Wp panels will be used, the solar array will be 9x20. Then each 9 panel series generates 38.2A then total current is 38.2x20= 764 A or you can use 38.2A; 20 no. of individual chargers for each series.

Selected System Specifications for the village considered

1. **Solar panels**
   Max power - 360 kW (180Wp*2,000)
   Solar Cell - Mono crystalline 125mm * 125mm or equivalent
   Size - 2 pieces in series & 6 teams in parallel connection
   Installation angle - Install at 0^0～60^0 from the horizontal
   Lifetime - 25 years at least; 2 year warranty on material and workmanship; 25 years limited warranty on power output

2. **Battery Bank**
   Rated Capacity - 5,400 Ahr
   Rated Voltage - 108 V
   Type - Deep cycle; Discharging rate < 60%
   Operating Temperature - —30℃～+60℃
   Life span - 20 years warranty and 25 years lifespan

3. **Charge Discharge Controller**
   Specification - 50A/110V; 20 units
   Lifespan - design lifespan 25 years & one year warranty

4. **Inverter**
   Input/ Output - AC 230/ 110V; 50Hz

Waveform - Inverted output of pure sin wave
Lifespan - design lifespan 25 years & one year warranty

5. **Conditions**

Charging conditions- 4-5 hours per day sunshine hours on average
Working Condition - as per Daily Load Profile Graph
Wind resistance - 60m/s
Mounting brackets & Accessories – corrosion prevention, anti-ultraviolet radiation
Price - quote CIF Ivory Coast

Estimated Cost – 50 kW System[21]

No	Description	Cost (USD)
1	**Solar Array with Accessories**	
	Solar Panel: 180 Wp/ Mono crystalline * 240 nos	200,000
	Mounting system	50,000
2	**Battery Bank with Accessories**	
	Deep Cycle Batteries: 5400Ah/ 108V	150,000
	Brackets, Connectors and Cables for batteries	17,500
3	**Solar Charge Controller**	7,500
4	**Inverter**	15,000
5	Junction Box	7,500
6	Control Cabinet	8,000
7	Wire and Cable (for Powerhouse)	5,500
8	Powerhouse building cost (4m * 3m *3m)	10,000
9	**Distribution Line**	
	Cost for concrete poles: USD 100 * 250 nos	25,000
	Cost for Cables: USD 1,000/km * 6km	6,000
	Cost for D Brackets (complete with bolts and nuts)	2,000
	Cost for Insulators	1,500
	Cost for Laying Line	2,500
10	House Wiring for 200 houses (Annexure 1)	20,000
	SUB TOTAL COST	528,000
	Contingency 10%	52,800
	TOTAL	**580,800**

Annexure **1: Cost of House wiring**[22]

[21] Cost of 100kW and 150 kW systems are in Annexure 4

TABLE 3: HOUSE WIRING COST FOR RURAL HOUSE

No	Item	Units	Number of Items	Unit Price /(USD)	Cost /(USD)
	Wiring				
1	Wire (1/0.44)	100m coil	2	10	20.0
2	Switches - 2 gang	Nos	2	1.5	3.0
3	Switches - 1 gang	Nos	1	1.0	1.0
4	Bulb Holders	Nos	5	0.2	1.0
5	MCB 6A – Orange	Nos	3	0.6	1.8
6	Casing (1")	3m	5	1.2	6.0
7	Wire clip	Pckt	6	0.1	0.6
8	Earth rod (1")	Nos	1	3.5	3.5
9	Sunk box	Nos	6	0.1	0.6
10	Ceiling rose	Nos	5	0.2	1.0
11	Plug base	Nos	1	2.0	2.0
12	Rawl plug & screws	Nos	50	0.03	1.5
13	ABC 500 Box	Nos	1	2.0	2.0
14	6 mm service wire TF/ (Cu)	M	30	1.2	36
15	Earth wire	M	20	0.3	6.0
	Sub Total				86.0
			Contingency	15%	17.2
	TOTAL COST PER HOUSE				**103.2**
	TOTAL COST FOR 200 HOUSE				**20,640**

[22] Cost based on international prices. Need to update to the home country prices.

Annexure 2: Trend of the Cost of Solar Modules

The change in the month-to-month result for the US and European Retail Prices Indices is calculated by assuming the same survey mix as the prior month, in other words it is "nomalized" to the prior month's modules. This means that module models dropped from the survey and new modules introduced to the survey each month are ignored in the calculation.

The module cost represents around 50 - 60% of the total installed cost of a Solar Energy System. Therefore the solar module price is the key element in the total price of an installed solar system. All prices tabulated are **exclusive of sales taxes**, which depending on the country or region can add 8-20% to the prices.

TABLE 4: TREND OF SOLAR MODULE COST[23]

125 Watts and Higher Module Index Retail Price Per Watt Peak		
	USA	Europe
	US$ / watt	Euro € / watt
Oct 2010	3.59	3.20
Sep 2010	3.61	3.23
Jun 2010	3.77	3.32
Mar 2010	3.83	3.40
Dec 2009	3.95	3.58
Sep 2009	4.09	3.79
Jun 2009	4.37	4.12
Mar 2009	4.57	4.31
Dec 2008	4.67	4.56
Sep 2008	4.70	4.64
Jun 2008	4.70	4.70
Mar 2008	4.73	4.73
Dec 2007	4.77	4.77
Sept 2007	4.85	4.78
June 2007	4.85	4.78

[23] Adapted from http://www.solarbuzz.com/ModulePrices.htm

Annexure 3: Possible Site Details

Ratings of Electrical Equipment & Duration of Use –Example							
Domestic/ Social Equipment	Watts	Hours	Period	Industrial Equipment	Watts	Hours	Period
Lamp (CFL)[24]	11	9	6pm-1 am 4am- 6am	Computer	150	7	9am-6pm
Television	200	4	6pm-10pm	Battery charger (vehicle)	1,000	10	8am-6pm
Fridge	200	8	1pm-9pm	Pump	1,000	5	9am-2pm
Ventilo	60	8	8am-4pm	Audio set	500	8	5pm-1am
Mobile phone charger	20	2	8am-9am 8pm-9pm	Welding set	1,000	6	9am-3pm
Water Pump[25]	5,000	8	8am- 4pm	Projector (cinema)	250	4	6pm-10pm
				Fridge	200	8	1pm-9pm
				Ventilator	40	5	9am-2pm
				Freezers	540	8	1pm-9pm
				Motor (Mill)	1,000	5	10am-3pm
				Lamps	11	9	6pm-3pm

[24] Instead of Tungsten filament lamps of 40 W it is advisable to use CFL or LED lamps with longer lifetime.
[25] Average water Pump capacity.

Annexure 4: Usage in Domestic, Social & Industrial Application

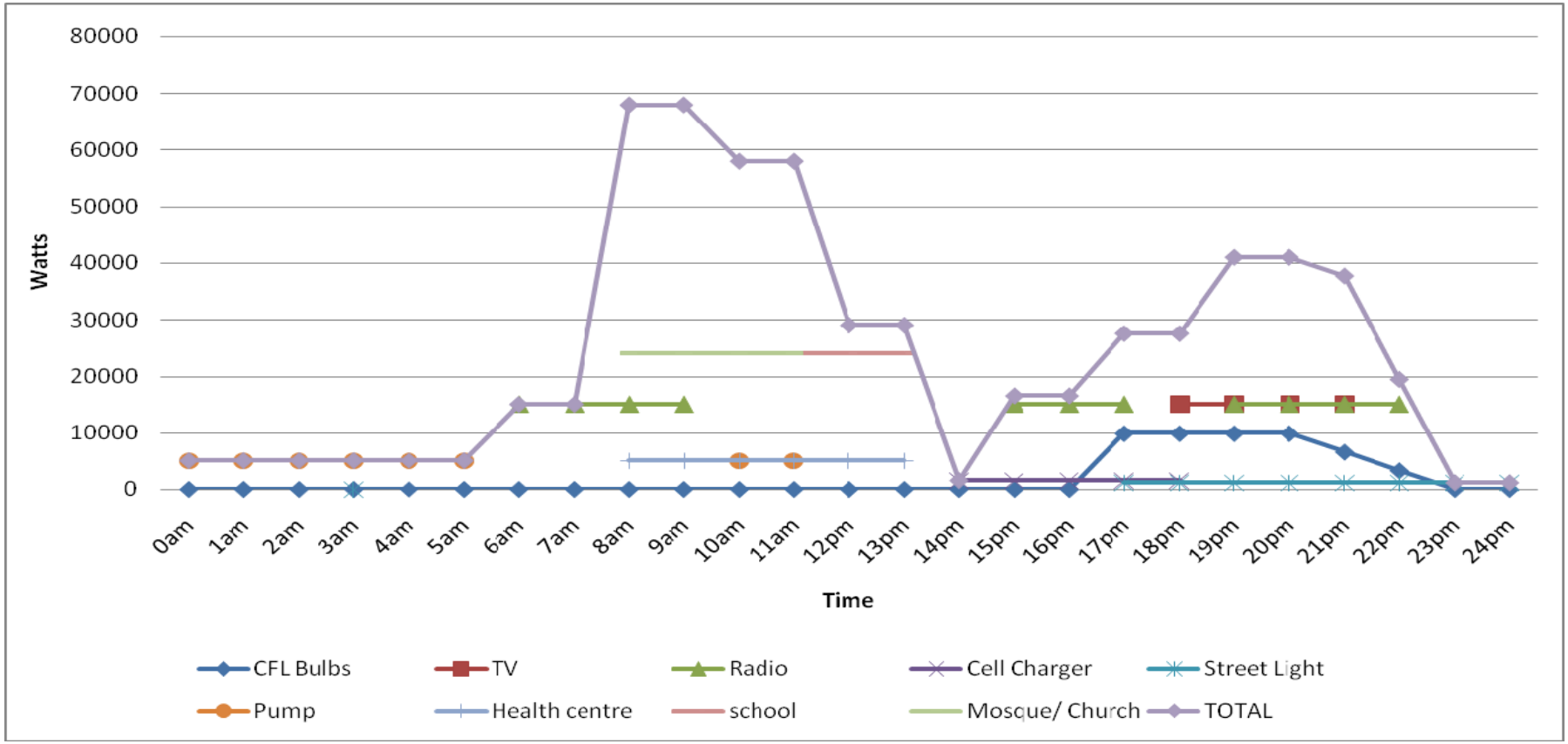
Based on the experience in other African countries with similar social, economic background, usage of electricity in various public and private places is listed as in the Table (7) below. "Present" use is the usage with the available sources of power when the project is designing. Once the entities get more reliable power, there can be new demands emerging and hence some provisions were made for the "future" usage.

TABLE 5

Domestic/ Social		Present Use (Watts)	Future Use (Watts)
1	PUMP Station	5,000[26]	5,000
2	HEALTH Center	200	5,000
3	SCHOOL	66	3,000
4	Mosque/ Church	66	500
5	OTHER Public places	66	500
6	HOME- High Income	595	600
7	HOME- Medium Income	275	300
8	HOME- Low Income	53	200
9	STREET Light (CFL or LED)	11	15
Industrial			
1	WATER Supply	1,011	1,500
2	GARAGE	1,022	1,500
3	WELDING Shop	1,022	3,000
4	RESTAURANT/ BAR/ CLUB	610	1,000
5	MEAT Grill	11	100
6	CELL PHONE Network	200	1,000
7	MILL	1,011	1,500
8	FOOD Store	551	750
9	SHOPS/ CINEMA/ PHAMACY/ HAIR DRESSER/ TAYLOR/ FUEL Station	250	500
10	OFFICE/ NGO	355	500

[26] This is an average size pump station and smallest can be in the range of 1 kW.

Annexure 5: Daily Load Profile



Note: 1. Peak Load as per above LOAD CURVE is 160 kW and this occurs at 6 pm.
2. Peal Load for Domestic/ social applications is 115 kW (occurs at 8pm) while the same for Industrial applications is closer to 80 kW (1pm).

ANNEX G: DETAILS OF POSSIBLE SITES

NIAMOUE

Les éléments de synthèse de l'enquête réalisée au niveau de NIAMOUE sont consignés dans le tableau ci-dessus :

Nom du village	**NIAMOUE**	Département		**BOUNA**		
Distance du transformateur /réseau le plus proche (km)	**75**	Région		**REGION DU ZANZAN**		
Nombre de ménages dans le village	**127**	Coordonnées GPS		**Latitude : 9,54** **Longitude : -3,36**		
Taille moyenne des familles	**6**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**6**	a) Pétrole lampant	**oui**	Nbre de litres par mois	**143**	Coût du litre **700 FCFA (1,4 $ US)**
Nombre moyen d'enfants scolarisés par ménage	**1**	b) Parc de batteries	**oui**	Nbre de charges par trimestre	**6**	Coût de la charge **1000 FCFA (2 $ US)**
Distance du ménage le plus éloigné du centre du village	**2000 m**	c) Système solaire PV	**oui**	Puissance installée (Wc)	**18**	Coût du système **75000 F CFA (150 $ US)**
Source de revenu la plus importante des villageois	**Agriculture**	d) Piles	**oui**	Besoins mensuels	**2485**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**50 177 FCFA (100,35 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 200 Litres/mois Coût du litre : 800 F CFA (1,6$US)** **Gas oil : 220 Litres/mois Coût du litre : 600 F CFA (1,2 $US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **6** La durée journalière d'ensoleillement **: 5**				
a)	a**) Mil**	**17.** Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Maïs**	a)		b)		c)
c)	c) **Anacarde**					
d)	d) I**gname**	d)		e)		f

ATOUMABO

Les éléments de synthèse de l'enquête réalisée au niveau d'Atoumabo sont consignés dans le tableau ci-dessus :

Nom du village	**ATOUMABO**	Département		**PRIKRO**		
Distance du transformateur /réseau le plus proche (km)	**30**	Région		**REGION DU N'ZI-COMOE**		
6 Nombre de ménages dans le village	**79**	Coordonnées GPS		**Latitude :** **Longitude :**		
Taille moyenne des familles	**6**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**4**	Pétrole lampant	**oui**	Nbre de litres par mois	**36,5**	Coût du litre **600 FCFA (1,2 $ US)**
Nombre moyen d'enfants scolarisés par ménage	**1**	Parc de batteries	**oui**	Nbre de charges par trimestre	**18**	Coût de la charge **1000 FCFA (2 $ US)**
Distance du ménage le plus éloigné du centre du village	**800 m**	Système solaire PV	**oui**	Puissance installée (Wc)		Coût du système
Source de revenu la plus importante des villageois	**Agriculture**	Piles	**oui**	Besoins mensuels	**1404**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**18 713 FCFA (37 $ US)**	Autres (spécifier la source et le coût mensuel) :				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **6** La durée journalière d'ensoleillement **: 5**				
a)	a**) Riz**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Arachide**	a) **Production de beurre de Karité**		b) **Production d'anacarde**		c) **Production de coton**
c)	c) **Anacarde**					
d)	d**) Roucou**	d)		e)		f

SOKOURABA

Les éléments de synthèse de l'enquête réalisée au niveau de Sokouraba sont consignés dans le tableau ci-dessus :

Nom du village	**SOKOURABA**	Département		**FERKE**		
Distance du transformateur /réseau le plus proche (km)	**05**	Région		**REGION DES SAVANE**		
Nombre de ménages dans le village	**38**	Coordonnées GPS		**Latitude : 10,2** **Longitude : -5,62**		
Taille moyenne des familles	**12**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**08**	Pétrole lampant	**Non**	Nbre de litres par mois		Coût du litre
Nombre moyen d'enfants scolarisés par ménage	**2**	Parc de batteries	**oui**	Nbre de charges par trimestre	**18**	Coût de la charge **750 FCFA (1,5 $ US)**
Distance du ménage le plus éloigné du centre du village	**900 m**	Système solaire PV	**Non**	Puissance installée (Wc)		Coût du système
Source de revenu la plus importante des villageois	**Agriculture**	5 Piles	**oui**	Besoins mensuels	**1704**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**83 982 FCFA (168 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 04 Litres/mois Coût du litre : 600 F CFA (1,2 $US)** **Gas oil : 249 Litres/mois Coût du litre : 600 F CFA (1,2 $US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **6** La durée journalière d'ensoleillement **: 6**				
a)	a**) Mil**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Maïs**	a)		b)		c)
c)	c) **Arachide**					
d)	d) **Coton, Riz**	d)		e)		f

SIKOLO

Les éléments de synthèse de l'enquête réalisée au niveau de Sikolo sont consignés dans le tableau ci-dessus :

Nom du village	**SIKOLO**	Département		**FERKE**		
Distance du transformateur /réseau le plus proche (km)	**30**	Région		**REGION DES SAVANE**		
Nombre de ménages dans le village	**79**	Coordonnées GPS		**Latitude : 9,4** **Longitude : -4,71**		
Taille moyenne des familles	**7**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**8**	Pétrole lampant	**non**	Nbre de litres par mois		Coût du litre
Nombre moyen d'enfants scolarisés par ménage	**1**	Parc de batteries	**oui**	Nbre de charges par trimestre	**16**	Coût de la charge **500 FCFA (1 $ US)**
Distance du ménage le plus éloigné du centre du village	**1000 m**	Système solaire PV	**oui**	Puissance installée (Wc)	**355**	Coût du système **2 475 000 F CFA (4950 $ US)**
Source de revenu la plus importante des villageois	**Culture et vente de maïs**	Piles	**oui**	Besoins mensuels	**3114**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**66 000 FCFA (132 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 237 Litres/mois Coût du litre : 800 F CFA (1,6$US)** **Gas oil : 139 Litres/mois Coût du litre : 700 F CFA (1,4 $US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **4** La durée journalière d'ensoleillement **: 6**				
a)	a**) Mil, sorgho**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Maïs, riz**	a) **Production de beurre de Karité**		b) **transformation d'anacarde**		c) **transformation de coton**
c)	c) **Arachide, haricot**					
d)	d) I**gname, coton**	d)		e)		f

ASSOUM 2

Les éléments de synthèse de l'enquête réalisée au niveau d'Assoum 2 sont consignés dans le tableau ci-dessus :

Nom du village	**ASSOUM 2**	Département		**BOUNA**		
Distance du transformateur /réseau le plus proche (km)	**13**	Région		**REGION DU ZANZAN**		
Nombre de ménages dans le village	**54**	Coordonnées GPS		**Latitude : 9,23** **Longitude : -3,06**		
Taille moyenne des familles	**7**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**6**	Pétrole lampant	**oui**	Nbre de litres par mois	**128**	Coût du litre **650FCFA (1,3 $ US)**
Nombre moyen d'enfants scolarisés par ménage	**1**	Parc de batteries	**non**	Nbre de charges par trimestre		Coût de la charge
Distance du ménage le plus éloigné du centre du village	**1000 m**	Système solaire PV	**non**	Puissance installée (Wc)		Coût du système
Source de revenu la plus importante des villageois	**Agriculture**	Piles	**oui**	Besoins mensuels	**984**	Coût des piles **125 FCFA (0,25 $ US)**
Revenu moyen par ménage	**27 000 FCFA (54 $ US)**	Autres (spécifier la source et le coût mensuel) : **Gas oil : 428 Litres/mois Coût du litre : 700 F CFA (1,4 $US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **6** La durée journalière d'ensoleillement **: 5**				
a) Unité de conditionnement de l'anacarde	a**) Mil, riz**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b) Unité de décorticage de riz	b) **Maïs, haricot**	a) **Moulin électrique**		b)		c)
c)	c) **Anacarde, sorgho**					
d)	d) I**gname**	d)		e)		f

NIANDEGUE

Les éléments de synthèse de l'enquête réalisée au niveau de Niandegué sont consignés dans le tableau ci-dessus :

Nom du village	**NIANDEGUE**	Département		**BOUNA**		
Distance du transformateur /réseau le plus proche (km)	**12**	Région		**REGION DU ZANZAN**		
Nombre de ménages dans le village	**33**	Coordonnées GPS		**Latitude : non connue** **Longitude : non connue**		
Taille moyenne des familles	**7**	Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**6**	Pétrole lampant	**oui**	Nbre de litres par mois	**16**	Coût du litre **700 FCFA (1,4 $ US)**
Nombre moyen d'enfants scolarisés par ménage	**2**	Parc de batteries	**non**	Nbre de charges par trimestre		Coût de la charge
Distance du ménage le plus éloigné du centre du village	**1000 m**	Système solaire PV	**oui**	Puissance installée (Wc)	**50**	Coût du système **200 000 F CFA (400 $ US)**
Source de revenu la plus importante des villageois	**Culture et vente d'igname**	Piles	**oui**	Besoins mensuels	**1121**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**102 000 FCFA (204 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 48 Litres/mois Coût du litre : 800 F CFA (1,6$US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **5** La durée journalière d'ensoleillement **: 6**				
a)	a**) Mil**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Maïs**	a)		b)		c)
c)	c) **Sorgho**					
d)	d) I**gname**	d)		e)		f

GBANGUE

Les éléments de synthèse de l'enquête réalisée au niveau de Gbangué sont consignés dans le tableau ci-dessus :

Nom du village	**GBANGUE**	Département		**MADINANI**		
Distance du transformateur /réseau le plus proche (km)	**13**	Région		**LE DENGUELE**		
Nombre de ménages dans le village	**33**	Coordonnées GPS		**Latitude : 9,28** **Longitude : -7,03**		
Taille moyenne des familles	**13**	**15.** Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
Nombre moyen de pièces par ménage	**9**	Pétrole lampant	**non**	Nbre de litres par mois		Coût du litre
Nombre moyen d'enfants scolarisés par ménage	**2**	Parc de batteries	**oui**	Nbre de charges par trimestre	**65**	Coût de la charge **1000 FCFA (2 $ US)**
Distance du ménage le plus éloigné du centre du village	**600 m**	Système solaire PV	**oui**	Puissance installée (Wc)	**145**	Coût du système **300 000 F CFA (600 $US)**
Source de revenu la plus importante des villageois	**Vente d'anacarde**	Piles	**oui**	Besoins mensuels	**2367**	Coût des piles **100 FCFA (0,2 $ US)**
Revenu moyen par ménage	**65 635 FCFA (132 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 30 Litres/mois Coût du litre : 800 F CFA (1,6$US)**				
Les industries dominantes dans la zone	Cultures dominantes dans la zone	Préciser les mois de pluie par an : **6** La durée journalière d'ensoleillement **: 6**				
a)	a**) Coton**	Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Maïs**	a) **Forge électrique**		b) **Ferronnerie**	c) **Moulin électrique**	
c)	c) **Anacarde**					
d)	d) **Arachide**	d) **Menuiserie**		e)	f	

- **Localité de N'gorankro 1**

11. Présentation de N'GORANKRO 1 :

N'Gorankro 1 est une localité d'environs 500 habitants située au sud de la Côte d'Ivoire à environ 140 Km d'Abidjan. Cette localité dispose des infrastructures suivantes :

- une école de 3 classes ;
- un point d'eau équipé d'une pompe manuelle ;
- une boutique ;

La culture du cacao est la principale source de revenu des habitants dont le revenu mensuel moyen par ménage est d'environ 82 000 F CFA soit 164 $ US.

Les principales sources d'énergie de la localité sont le pétrole lampant, l'essence, les piles et les batteries. Les dépenses mensuelles dédiées à la satisfaction des besoins énergétiques (hors charbon ou bois de chauffe), par ménage, sont évaluées en moyenne à 3000 F CFA soit 6 $ US.

12. Les éléments de synthèse de l'enquête réalisée au niveau de la localité de **N'gorankro 1** sont consignés dans le tableau ci-après :

1. Nom du village	**N'GORANKRO 1**	**1.** Département	**GRAND-LAHOU**			
5. Distance du transformateur /réseau le plus proche (km)	**15**	**2.** Région	**REGION DES LAGUNES**			
6. Nombre de ménages dans le village	**99**	**3.** Coordonnées GPS				
7. Taille moyenne des familles	**5**	**15.** Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
8. Nombre moyen de pièces par ménage	**5**	a) Pétrole lampant	**oui**	Nbre de litres par mois	**189**	Coût du litre **500 FCFA (1$US)**
9. Nombre moyen d'enfants scolarisés par ménage	**2**	b) Parc de batteries	**oui**	Nbre de charges par trimestre	**50**	Coût de la charge **1300 FCFA (2,6$US)**
10. Distance du ménage le plus éloigné du centre du village	**500 m**	c) Système solaire PV	**non**	Puissance installée (Wc)	**0**	Coût du système
11. Source de revenu la plus importante des villageois	**CACAO**	d) Piles	**oui**	Besoins mensuels	**1185**	Coût des piles **100 FCFA**
12. Revenu moyen par ménage	**82 000 FCFA**	Autres (spécifier la source et le coût mensuel) **ESSENCE : 79 000 FCFA/mois**				
13. Les industries dominantes dans la zone	**14.** Cultures dominantes dans la zone	**16.** Préciser les mois de pluie par an :				
a)	a) **CACAO**	**17.** Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **CAFE**	a) **Vente de boissons et de jus**		b) **Boutique**		c) **Restaurant/Buvette**
c)	c) **PALMIER**					
d)	d) **HEVEA**	d) **Vidéo – Club**		e) **Poissonnerie**		f) **Photocopieuse**

Localité de Dokpodon

13. Présentation de DOKPODON :

Située au Sud de la Côte d'ivoire, la localité de Dokpodon a une population d'environ 1000 habitants. Elle dispose des infrastructures suivantes :

- Une école de 6 classes et 6 logements d'instituteurs ;
- Un dépôt de pharmacie ;
- Un marché ;
- Une case de santé.

La principale source de revenus est la culture du Cacao. Cependant, le commerce constitue une source non négligeable de revenus.

L'essence, le pétrole lampant, les batteries et les piles sont les principales sources d'énergies pour les besoins d'éclairage, d'audio-visuel mais aussi pour les activités économiques. Les dépenses mensuelles dédiées à la satisfaction des besoins énergétiques (hors charbon ou bois de chauffe), par ménage,

sont évaluées en moyenne à 10716 F CFA soit 21,4 $ US.

14. Les éléments de synthèse de l'enquête réalisée au niveau de la localité de **Dokpodo**n sont consignés dans le tableau ci-après :

1. Nom du village	**DOKPODON**	**2.** Département		**GRAND-LAHOU**		
5. Distance du transformateur /réseau le plus proche (km)	**15**	**3.** Région		**REGION DES LAGUNES**		
6. Nombre de ménages dans le village	**143**	**4.** Coordonnées GPS		Latitude : 5,1 Longitude : -5,4		
7. Taille moyenne des familles	**6**	**15.** Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
8. Nombre moyen de pièces par ménage	**6**	e) Pétrole lampant	**oui**	Nbre de litres par mois	**295**	Coût du litre **500 FCFA**
9. Nombre moyen d'enfants scolarisés par ménage	**2**	f) Parc de batteries	**oui**	Nbre de charges par trimestre	**165**	Coût de la charge **1300 FCFA**
10. Distance du ménage le plus éloigné du centre du village	**1000 m**	g) Système solaire PV	**oui**	Puissance installée (Wc)	**500**	Coût du système
11. Source de revenu la plus importante des villageois	**CACAO**	h) Piles	**oui**	Besoins mensuels	**4244**	Coût des piles **100 FCFA**
12. Revenu moyen par ménage	**98 000 FCFA**	Autres (spécifier la source et le coût mensuel) : **ESSENCE : 676 000 FCFA/mois** : **GAZ : 70 000 FCFA /mois**				
13. Les industries dominantes dans la zone	**14.** Cultures dominantes dans la zone	**15.** Préciser les mois de pluie par an : **16.** La durée journalière d'ensoleillement :				
a)	a) **CACAO**	**17.** Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **CAFE**	a) **Vente de boissons et de jus glacés**		b) **Restaurant – Buvette**	c) **Atelier de mécanique et de soudure / Moulin / Menuiserie**	
c)	c) **PALMIER**					
d)	d) **HEVEA**	d) **Vidéo – Club et Discothèque**		e) **Boutique**	f) **Atelier de Coiffure / de Couture/Blanchisserie**	

• Localité de Yéouli

15. Présentation de la localité de YEOULI :

YEOULI est une localité d'environs 400 habitants, située à l'extrême sud-est de la Côte d'Ivoire et faisant frontière avec la république du Liberia à travers le fleuve Cavally. Cette localité dispose des infrastructures suivantes :

- Une école de trois (3) classes et deux (2) logements d'instituteurs ;
- D'une case de santé ;
- de trois (3) boutiques de vente d'articles divers.

L'activité principale des populations est l'agriculture. Le palmier à huile et l'hévéa sont les principales cultures. Cependant, le complexe agro-industriel de production d'huile de palme, PALM-CI, est pourvoyeur d'emplois pour une partie de la population de la localité.

Pour ses besoins énergétiques la population utilise principalement le pétrole lampant et les piles. Les dépenses mensuelles dédiées à la satisfaction des besoins énergétiques (hors charbon ou bois de chauffe), par ménage, sont évaluées en moyenne à 6029 F CFA soit 12 $ US.

Le réseau électrique national est à 30 Km de Yéouli et le réseau de distribution de la PALM-CI à moins de 15 Km.

Quelques données utiles sur Yéouli:

Yéouli est situé à proximité d'une industrie agro-industrielle en bordure du fleuve Cavally faisant frontière avec le Libéria. Cette localité dispose d'une école primaire et d'une case de santé, les cultures de palmier et d'hévéas constituent les principales sources de revenus, cependant la production et la vente d'alcool constitue une source de revenu non-négligeable.

16. Les éléments de synthèse de l'enquête réalisée au niveau de la localité de **Yéouli** sont consignés dans le tableau ci-après :

1. Nom du village	**YEOULI**	**2.** Département		**TABOU**		
5. Distance du transformateur /réseau le plus proche (km)	**30**	**3.** Région		**REGION DU BAS SASSANDRA**		
6. Nombre de ménages dans le village	**44**	**4.** Coordonnées GPS :		Latitude :4,5 Longitude : -7,6		
7. Taille moyenne des familles	**8**	**15.** Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
8. Nombre moyen de pièces par ménage	**6**	a) Pétrole lampant	**oui**	Nbre de litres par mois	**141**	Coût du litre **800 F CFA (1,5 $US)**
9. Nombre moyen d'enfants scolarisés par ménage	**3**	b) Parc de batteries	**oui**	Nbre de charges par trimestre	**12**	Coût de la charge **1000 F CFA (2 $US)**
10. Distance du ménage le plus éloigné du centre du village	**1000**	c) Système solaire PV	**non**	Puissance installée (Wc)	**0**	Coût du système 0
11. Source de revenu la plus importante des villageois	**Culture de palmier à huile et d'hévéas**	d) Piles	**oui**	Besoins mensuels	**924**	Coût des piles **125 FCFA (0,25 $US)**
12. Revenu moyen par ménage	**166 000 FCFA (332 $US)**	Autres (spécifier la source et le coût mensuel) : (Moyenne : L/mois) - **Essence : 33Litres/mois Coût du litre : 1000 F CFA (2$US)** **:**				
13. Les industries dominantes dans la zone	**14.** Cultures dominantes dans la zone	**15.** Préciser les mois de pluie par an : **9** **16.** La durée journalière d'ensoleillement **: 4 heures**				
a)l'Agro-industrie de production d'huile de palme	a) Palmier à huile	**17.** Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) hévéas	a)Vente de bois glacée		b) ouverture de boutique de vente d'articles divers		c)
c)	c) Canne à sucre					
d)	d)	d) ouverture de club-vidéo		e)		f)

- **Localité de Gnato**

17. Présentation de GNATO :

La localité Gnato est une bourgade de plus de 2000 habitants devenue tout récemment commune rurale. Cette localité dispose des infrastructures suivantes :

- une école de 6 classes et de 6 logements des instituteurs;
- un centre de santé en construction dans le cadre d'un projet de l'UNICEF,
- un marché où les habitants des villages alentours viennent s'approvisionner.

Pour la satisfaction de leurs besoins énergétiques, les populations utilisent principalement les groupes électrogènes alimentés au (gas oil et à l'essence), les lampes chinoises à pile ainsi que les lampes alimentés par le pétrole lampant. Le manque d'électricité pour la satisfaction des besoins domestiques, mais surtout des besoins liés à l'activité économique, a engendré un commerce illégal d'énergie électrique dont la source de production est constituée de groupe électrogène. Les dépenses mensuelles dédiées à la satisfaction des besoins énergétiques (hors charbon ou bois de chauffe), par ménage, est évaluée en moyenne à 22 483 F CFA soit 44,9 $ US.

Le réseau électrique national est situé à environs 60 Km de Gnato cependant la PALM-CI a son réseau de distribution produit à partir de ses résidus agricoles et situé à moins de 20 km de Gnato.

18. Les éléments de synthèse de l'enquête réalisée au niveau de la localité de **Gnato** sont consignés dans le tableau ci-après

1. Nom du village	**GNATO**	**2.** Département		**TABOU**		
5. Distance du transformateur /réseau le plus proche (km)	**60**	**3.** Région		**SOUS-PREFECTURE DE GRABO REGION DU BAS SASSANDRA**		
6. Nombre de ménages dans le village	**166**	**4.** Coordonnées GPS		Latitude : **4,43** Longitude **: -7,3**		
7. Taille moyenne des familles	**7**	**15.** Sources actuelles d'énergie pour l'éclairage, la radio, la TV (à l'exception des cuisinières) : Moyenne				
8. Nombre moyen de pièces par ménage	**7**	a) Pétrole lampant	**oui**	Nbre de litres par mois	**459**	Coût du litre **750 F CFA (1,5 $US)**
9. Nombre moyen d'enfants scolarisés par ménage	**2**	b) Parc de batteries	**oui**	Nbre de charges par trimestre	**170**	Coût de la charge **1000 F CFA ($ US)**
10. Distance du ménage le plus éloigné du centre du village	**1000 m**	c) Système solaire PV	**oui**	Puissance installée (Wc)	**370**	Coût du système **492 F CFA (984 $ US)**
11. Source de revenu la plus importante des villageois	**La culture du Cacao, du palmier à huile et de l'hévéa**	d) Piles	**oui**	Besoins mensuels	**11795**	Coût des piles **125 FCFA (0,25 $US)**
12. Revenu moyen par ménage	**255 000 F CFA (510 $ US)**	Autres (spécifier la source et le coût mensuel) : **Essence : 1545 Litres/mois Coût du litre : 1000 F CFA (2 $ US)** **Gas oil : 390 Litres/mois Coût du litre : 800 F CFA (1,6 $ US)** :				
13. Les industries dominantes dans la zone	**14.** Cultures dominantes dans la zone	**15.** Préciser les mois de pluie par an : 9 **16.** La durée journalière d'ensoleillement **: 4 heures**				
a)**Agro-industrie de production d'huile de palme (PALM-CI)**	a) **Palmier à huile**	**17.** Petites industries à promouvoir en cas de disponibilité d'électricité				
b)	b) **Cacao**	a) **Production de glace**		b) **vente de boisson glacée**	c) **charge de batteries**	
c)	c) **Café**					
d)	d) **Hévéas**	d)		e)	f)	