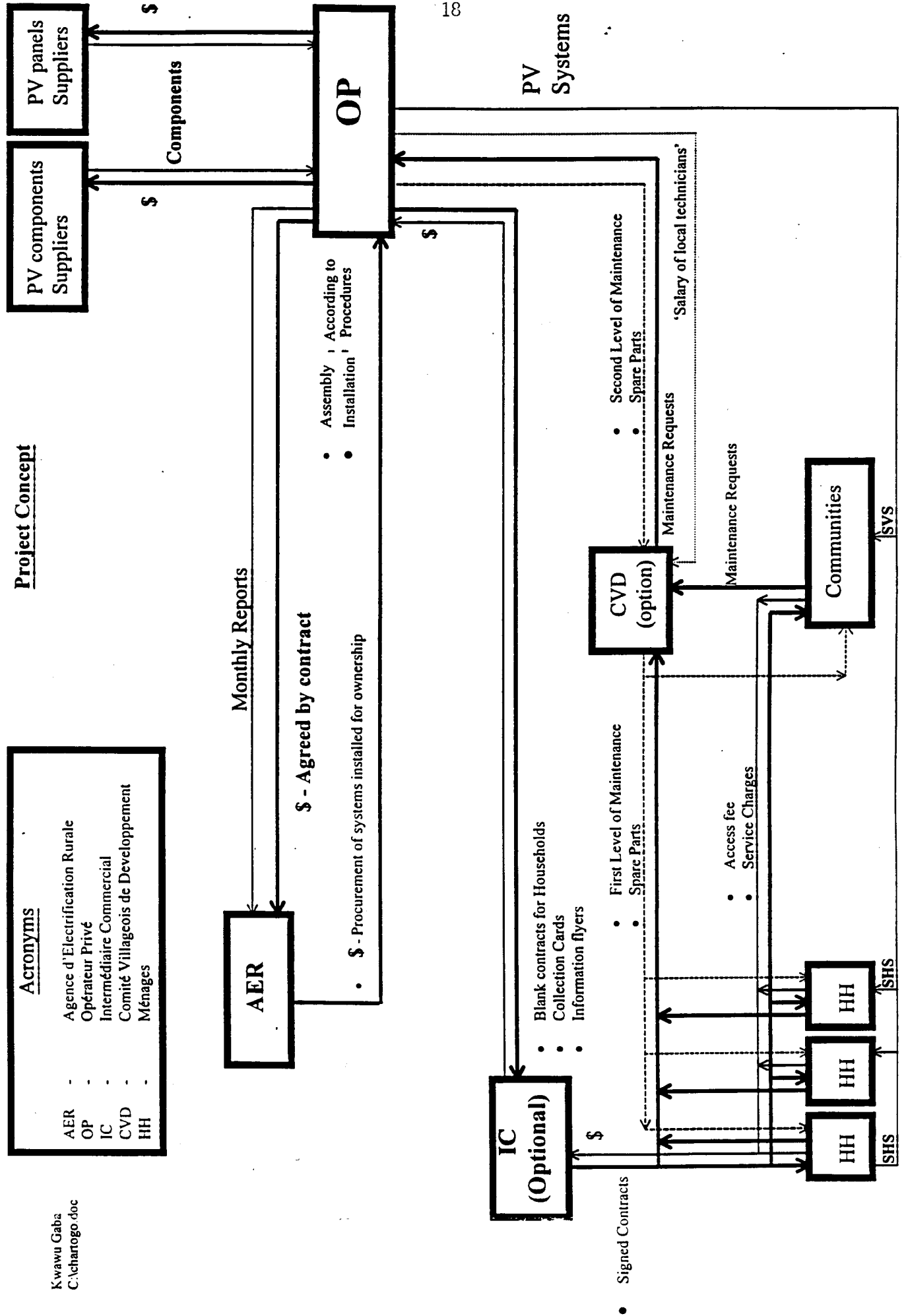


Acronyms

AER	-	Agence d'Electrification Rurale
OP	-	Opérateur Privé
IC	-	Intermédiaire Commercial
CVD	-	Comité Villageois de Développement
HH	-	Ménages

Project Concept



Annex 1
Benin: Decentralized Rural Energy Project
Incremental Cost and Global Environmental Benefits of The
Renewable Energy Component
(5 years)

Broad Development Goals

1. Benin's basic goals and policies for the development of the energy sector highlight the importance to reduce the country's heavy reliance on energy imports and promote the economic expansion of energy supplies to rural communities through the development of the country's indigenous resources, especially renewable energy for decentralized use. This strategy is expected to, inter alia, improve the provision of basic services and foster rural development.

Baseline

2. Given the low electrification rate of Benin, many rural households usually purchase kerosene and disposable batteries to meet their lighting and small power needs. Communities or villages rely on kerosene and diesel units to meet their lighting and power needs whenever possible. According to Government statistical data, kerosene represented the primary source of lighting for about 87 % of the population in 1994 and average household expenditures on commercial energy ranges between US\$2 and US\$12 per month. While some of these households (about 10 to 15% of the 385,000 households) and communities have the potential income to pay for grid-based electricity supply at prevailing tariffs, this service is neither available to them now nor is it likely to be available to them in the medium term. At the same time, the market penetration of renewable is hampered by a series of barriers as outlined in section B.2. Thus, the baseline course of action is that these households/communities will continue to rely on fossil fuel for their electricity needs, initially with current mix but slow conversion to diesel.

Global Environmental Objective

3. The project supports the GEF climate change Operational Program #6 aimed at promoting the adoption of renewable energy by removing barriers and reducing implementation costs.

4. The baseline course of action will lead to emissions of greenhouse gases (CO₂). Thus the global environmental objective of this decentralized rural energy project is the mitigation of GHG emissions from the use of kerosene for households and community lighting. Total GHG emissions are expected to be reduced by 13,000 tons of CO₂ over the lifetime of the project. This mitigation is the rationale for the GEF grant.

GEF Alternative

5. The GEF alternative to the baseline scenario is the provision of electricity service to at least 5,000 households over a five-year period through an ESCO delivery mechanism in the Zone Extrême Nord Benin, Zone Cotonnière du Nord Benin, and Zone des Pêcheries. These zones have been selected based upon the availability of solar radiation, population density in rural areas, disposable income and opportunities for private sector operation. The GEF alternative will also include capacity building and

PV markets development activities which would contribute to the removal of barriers to the adoption of PV systems.

6. Apart from the provision of electricity, additional benefits accrue to the households/communities from increased convenience and safety, improved indoor air quality and a higher quality of light (more consistent illumination, better color rendering). However, since data is insufficient to calculate these benefits, there are not included in the analyses.

Costs

7. Surveys undertaken during project preparation determined the type and size of the systems in which the target population were strongly interested: 20 and 50 Wp SHS were preferred because of the possibility of having at least 2 to 4 lighting points and/or a radio and television.

8. At present, PV is cheaper than other high quality solution like diesel units. However, PV is more expensive than the baseline solutions until market reaches a good size. Also a demonstration project of higher quality light is needed to increase consumer willingness to pay. Based on survey data and secondary information about prices, the incremental cost of PV systems for households, as compared to baseline solutions, reveals a 15-year life cycle cost of US\$ 112.86 for solar lanterns, a cost of US\$134.89 for the 20 Wp systems and a cost of US\$199.49 for the 50 Wp systems, depending on the level of service (using a 12% discount rate, as it is for the World Bank project under preparation).

System	Lifetime Cost (\$)	Lifetime Cost of Baseline (\$)	Increment (\$)	Tons of CO2 avoided
Lantern	218.66	105.75	112.91	1.37
20 Wp	497.31	362.41	134.89	2.99
50 Wp	999.75	800.26	199.49	3.49

Table 1: Incremental Cost for Households over the 15-year equipment lifetime

9. In order to smooth the transition from baseline options to GEF alternative, households and communities will receive a first cost grant based upon the level of service required. The grant will be phased out gradually and completely by the end of the project. At that time, households would pay the economic cost for service delivery. As the private operator will sell solar lanterns on a credit basis (over a 2-year period) and provide electricity service to households requesting 20 and 50 Wp systems, the first cost grant would be phased out according to the plan below:

System	Access fee (\$)	Annual Service Charges (\$)					
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Lantern		63.64	63.64	63.64	63.64	63.64	
20 Wp	18.18	36.36	36.36	18.18	18.18	9.09	0
50 Wp	36.36	54.55	54.55	27.27	27.27	9.09	0

Table 2: Phasing out of the First Cost Grant over the project life

10. For a customer requesting 20 Wp service in the 3rd year, he will receive a first cost grant of \$18.18 for the access fee, \$18.18 for the service charges the first year, \$18.18 for the 2nd year and \$9.09 for the third year (5th year of the project). The total first cost grant that he would have received at the end of the project will be \$63.64. At the end of the project, the equivalent grant received by private customers would be:

Equivalent Grant to Customers of (\$)						
System	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Lantern*	63.64	63.64	63.64	63.64	63.64	0
20 Wp	136.36	100.00	63.64	45.45	27.27	0
50 Wp	209.09	154.54	100.00	72.72	45.45	0

*: First cost grant for the lantern remains constant and is below incremental cost because the lantern is sold to the customer on a credit basis over 2 years.

Table 3: Equivalent GEF First Cost Grant for Households

11. In order to promote community equipment, a first cost grant will also be given to communities that will be selected. The size of the grant will be equivalent to half the access fee that would be requested.

Equivalent Grant to Customers (Communities) of (\$)						
System	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
Street Lighting (per Unit)	90.91	90.91	90.91	90.91	90.91	0
Entertainment Center	227.27	227.27	227.27	227.27	227.27	0

Table 4: Equivalent GEF First Cost Grant for Communities

12. In addition to the first cost grant, incremental costs arise from: (i) market development activities; (ii) information campaigns and training, (iii) consultancy services (technical studies & studies).

PROJECT INCREMENTAL COSTS CALCULATION SUMMARY

	Baseline	GEF Alternative	Increment
Domestic Benefit	Lighting and small power needs	Lighting and small power needs	-
Global Benefit	Some 13,000 tons of CO2 emissions	PV market breakthrough + No CO2 emissions	PV market breakthrough + Abatement of 13,000 tons of CO2 emissions
COSTS (US\$)			
(1) Lifetime Cost of Equipment	3,577,087	4,121,423	544,336
(2) Market Development Activities	0	101,111	101,111
(3) Information Campaigns and Training	63,637	308,846	245,209
(4) Consultant Services	120,000	364,200	244,200
(5) Operation and Equipment of AER	539,091	539,091	0
(6) Contingencies	310,000	310,000	0
TOTAL PROJECT COST	4,609,815	5,744,671	1,134,856

Assumptions: 15 year projections, 5 year project duration, 12% discount rate

Table 5: Project Incremental Costs Calculation

The requested GEF grant is rounded up to US\$ 1,135,000. Table 6 presents a breakdown of the GEF grant per year.

Table 6 : TOTAL ESTIMATED GEF CONTRIBUTION

	Year					Total
	1	2	3	4	5	
Number of Households using PV systems	600	1,500	1,500	720	690	5,010
Number of Communities using PV systems	20	50	50	24	23	167
Incremental Cost for Solar PV alternative :						
First Cost Grant for Households and Communities (20 Wpt+)	25,500	75,150	69,450	57,960	36,255	264,315
First Cost Grant for Households for the purchase of lanterns	4,200	10,500	10,500	5,040	4,830	35,070
Market Development Activities	6,660	16,650	16,650	7,992	7,659	55,611
Information Campaigns and Training	66,600	49,950	6,105	6,105	6,105	134,865
Accreditation Program for PV Technicians	22,200	22,200	0	0	0	44,400
Solar Resource Characterisation	22,200	5,550	0	0	0	27,750
Multimedia Consumer Awareness Programs	22,200	22,200	6,105	6,105	6,105	62,715
Technical Assistance and Studies	61,050	12,210	36,630	6,105	18,315	134,310
Technical Specifications for Standard Bidding Documents (1.5 m-m)	18,315	0	0	0	0	18,315
Bid Evaluation Activities (0.5 m-m)	6,105	0	0	0	0	6,105
Tariff, Consumer Contract (2.5 m-m)	12,210	0	6,105	0	12,210	30,525
Lease/Affermage Contract (2 m-m)	12,210	0	12,210	0	0	24,420
Quality Control (Inspection) of the Components/Spare Parts (1 m-m)	6,105	0	6,105	0	0	12,210
Quality Control for Systems Installation and Operation (3.5 m.m)	6,105	12,210	12,210	6,105	6,105	42,735
Total for Incremental Costs (KFCFA)	164,010	164,460	139,335	83,202	73,164	624,171
Total for Incremental Costs (US\$)	298,200	299,018	253,336	151,276	133,025	1,134,856

Annex II
Project Design Summary
(2000 - 2005)

Benin : Decentralized Rural Energy Project

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
<p>Sector-related CAS Goal:</p> <p>1. Encourage and support the private sector response and ensure adequate provision of basic social services</p> <p>2. Promote renewable energy technology and mitigate CO2 emissions</p>	<p>1.1 Increased share of customers serviced by private operators in the power sector.</p> <p>1.2 Increased number of private operators providing electricity services in Benin.</p> <p>2.1 Increased share of photovoltaic technology in electricity generation (PV market share)</p> <p>2.2 Avoided CO2 emissions (target: >13 kt CO2 avoided)</p>	<p>Banks reports</p> <p>Ministry of Energy Reports</p>	<p>(Goal to Bank Mission)</p> <ul style="list-style-type: none"> • Uniform approach of donors • Macroeconomic stability continues
<p>Project Developpt Objective:</p> <p>1. Provide rural households that have moderate-to-high cash incomes but little prospect of obtaining electricity service from the grid with affordable and reliable renewable electricity supply by establishing viable, technically-capable and privately-owned and operated solar photovoltaic (PV) equipment supply and service operations.</p> <p>2. GEF: Remove barriers and lower implementation costs of solar PV:</p> <ul style="list-style-type: none"> - lack of market information by suppliers - high up-front cost - installation/service network - implementation costs 	<p>1.1 By 2005, electricity service to > 5,000 households</p> <p>2.1 Number of SHS installed</p> <p>2.2 Size of access fee</p> <p>2.3 Consumer satisfaction > 80%</p> <p>2.4 Installation & maint. per Wp</p>	<ul style="list-style-type: none"> • Quarterly progress reports of AER • Mid-term review • Annual reports of lease companies • Implementation Completion Report. • Field surveys. 	<p>(Objective to Goal)</p> <ul style="list-style-type: none"> • Continued Government commitment to private sector participation • Sustained growth of the PV rural markets. • Private sector interest sustained • AER perform regulatory functions

<p>Outputs:</p> <p>1. Installation and operation of PV systems</p> <p>2. Improved environment for private sector provision of electricity services</p> <p>3. Training to enhance public sector capability</p> <p>4. Consumer awareness programs</p>	<p>1.1. Installation of at least 125 kWp of PV systems by 2005</p> <p>1.2 Establishment of 2 private operators in targeted areas by mid-term</p> <p>2.1 By 2001, issuance of standard contracts (for lessor and consumer); PV technical standards and certification procedures, Code of Practice.</p> <p>3.1 By 2002, 2 local staff of AER trained on regulatory issues & enforcement of certification procedures</p> <p>4.1 By 2001, 03 consumer awareness campaigns organized in targeted zones.</p> <p>4.2 By 2002, 09 consumer awareness campaigns and project promotion campaigns organized.</p>	<ul style="list-style-type: none"> • Procurement and disbursement records • Bank supervision reports • Quarterly progress reports of AER • Lease companies annual reports • Consumer surveys • Project mid-term review • Training records of AER • Consultants reports • Quarterly progress reports of AER • Consumer surveys • Records on events of the project promotion program 	<p>(Outputs to Objective)</p> <ul style="list-style-type: none"> • Continued consumer's ability to pay for the services that meet their expectations • AER perform regulatory functions • Technical performance of PV systems installed
<p>Project Components/Sub-components:</p> <p>1. Procurement, installation and operation of PV systems</p>	<p>Disbursement of IDA and GEF funds according to schedule</p>	<ul style="list-style-type: none"> • Procurement and disbursement records • Bank supervision reports • Quarterly progress reports of AER • Lease companies annual reports • Project mid-term review 	<p>(Components to Outputs)</p> <ul style="list-style-type: none"> • Unsatisfactory institutional arrangement and managerial capability of AER • Private sector interest and ability to undertake assignment • Government interference in selection of communities and

2. Capacity Building Program		<ul style="list-style-type: none">• Training records of AER• Consultants reports	implementati on of cost recovery policy • Targeted training plans are designed and strictly implemented.
------------------------------	--	---	--