

## **CHAPTER 4 PROPOSED BUSINESS MODEL FOR PV RURAL ELECTRIFICATION --- TOWARDS ARRANGEMENT OF PV MARKET---**

### **4.1 Preface**

In the previous chapter 3, the standard business model was introduced as shown in Chart 4.1 for the rural electrification under public-private initiative. The private business entity (called as an operator) is intended to play a major role while the rural community plays a supplemental role. Specifically speaking, the private entity is fully responsible for provision of quality service and fund management for a concession period while he implements, operates and manages a project. This concept is principally in cope with the Procedure Manual of ASER.

As a matter of fact, prior to implementing the project, several parameters addressed in the Procedure Manual or JICA PV System Manual (here-in-after called as Manual), shall be quantified and finally the tariff for "fee for service" shall be determined. The process is not different from that in the planning stage discussed in the previous Chapter 3.

However, in really implementing a private-public initiative project for the rural electrification, prior mutual understanding among the parties concerned will be prerequisite for determining the parameters critical to the profitability of the operator. Among them, the period of the concession, application method of subsidy, appropriate profitability, etc. will be major factors for determining the final tariff to be proposed to the rural population. On these matters, the parties concerned such as ASER, MMEH, CRSE (Government side), private business entities, rural electrification consultants, NGOs (Private sector side) experts shall discuss and have a view jointly through the process of *tariff setting toward construction of the Business Model as discussed later.*

In this chapter, the Business Model (draft), consisting of "Project Formation" and "Financial Model", has been proposed for more sincere discussion among the parties concerned towards the market arrangement for the rural electrification under the public-private initiative. The objective is to provide the rural population with good quality service and to avoid too much burden on any stakeholder (reasonable dispersion of risk), and alleviate the financial burden on rural population (in due consideration of his capacity to pay). Subsequently, the discussion will be concentrated on the matters such as the role and responsibility of the private business entity (called as an operator) and rural community/rural population, being related to "project formation" in which the reliable

partnership between them will be vital, and the adequate profitability of the private entity and the method of tariff setting, being related to "financial model".

Particularly, concerning the project formation, at the outset, the project is only lighting-oriented electrification, not for product-use electrification. However, the process of the project implementation, consisting of socio-economic survey, prior public consultation, briefing of the concept of "fee for service", presentation of tariff for fee for service, etc., should be recognized to be very important, rather critical to the success of the project. Because, through the period prior to implementation, some kind of reliable relationship shall be created among the private entity and rural population. This process should not be disregarded. Eventually, the process prior to the implementation, could contribute more or less to the capacity building of the rural community. Therefore, in this respect, the lighting-oriented electrification may be hopefully defined as the first step toward the socio-economic development for a self-sustainable rural community.

This kind of sign was recognized in the implementation of the Pilot Project in Mar Island, which had one-year experience of operation as at December 2001. The coming economic development will to a large extent depend on the development of the partnership based on the reliable relationship between the private entity and the rural population. From this aspect, the continuous monitoring of the pilot project will be greatly useful in making more practical business model, focusing not only on the operation condition of PV system, but also on fee collection and evolution of community empowerment, and creation of business opportunity attributed to the development of the above partnership.

Furthermore, it is mutually understood among ASER, MMEH and JICA that the pilot project in Mar Island will be regarded as Model Village for Rural Electrification and fully utilized as a tool of global diffusion of ASER's rural electrification, in which the process and the present situation of the pilot project implementation will be introduced to the rural population in non-electrified villages. Subsequently, continuous monitoring shall be necessary and useful so that ASER will be strongly advised to allocate an appropriate budget for this purpose.

Finally, in accomplishing such objectives as addressed in the proposed Business Model, it should be noted that the process such as planning, implementation, operation and maintenance will not be realized without the awareness and understanding of the parties concerned towards the following principle:

***“The objective is to improve the standard of living for the population in non-electrified villages under an environment of market economy in Senegal. “***

In other terms, it should be well noted among the government officials, private sectors, etc. that the paradigm has been changed from the conventional public-sector initiative to the public-private joint initiative in the sub-sector of rural electrification infrastructure. That means, the key to supplying energy services to people in rural areas lies in a shift of thinking away from large, centralised power grids towards smaller, decentralised systems-particularly systems based on renewable energy technologies.

#### **4.2 Structuring Business Model**

The Business Model is composed of “Project Formation” and “Financial Model”. The parameters adopted in the latter financial model will be realized only when the project formation functions well as anticipated. Therefore, if the performance of the parties concerned such as ASER, operator, rural community/rural population is good, the cash flow will be eventually improved, resulting in reduction in tariff based on the review of fund management. Of course the opposite case will happen due to poor performance. The financial model is designed to be modified flexibly in cope with the performance of the project.

Above all, the renewal of the PV components, for instance, batteries, which will affect greatly the cash management, has been discussed in the financial model, taking into account current price of them at the renewal time and the tariff will be reviewed regularly subject to the clause of the contract. These kind of transparent project management and fund management will be required to make the project technically and financially sustainable.

The fee-for-service adopted in the Business Model carries greater commercial risk due to the longer cost-recovery period. In this respect, the model allows the operator to recover the investment capital in 10 years, if the performance during the initial 10 years be judged as excellent by ASER and accepted by the village users association (VUA) under such condition that the system be surely and satisfactorily managed by the village users association. It should be noted that this kind situation never happens without establishment of a reliable relationship between the Operator and VUA.

It is recognized among the Senegalese persons involved in the Pilot project in Mar island that the reliable relationship among Supplier/Operator, ASER/MMEH/JICA, VUA, was established in the pre-implementation stage and the implementation stage. This fact, not exaggerated, should be recognized and appreciated particularly by the Senegalese people. This was a critical factor to the success of the pilot project as well as to the global rural electrification. Among others, the fact of providing the rural population with good quality service and collecting the fee in a satisfactory manner is itself a fruit of efforts of the people engaged in this project. The important lesson from this project is truly the establishment of the reliable relationship, which leads to the success of the project. In this sense, this lesson indicates that the Business Model her-in-with proposed never works properly without reliable relationship/partnership among the parties concerned to be established prior to the implementation..

#### **(1) Perspective of Pilot Project**

As at December 2001 one year after the commencement of the operation, all the PV system works satisfactorily and the fee collection is made smoothly without significant problem such as refusal of payment. However, as addressed in the Chapter 4.2, the tariff increase will be unavoidable when renewal of batteries are expected to take place 4 years after installation.

Furthermore, during the 5 year management period stipulated in the Management Contract between ASER and Operator, additional installation (200 subscribers in the waiting list) will be possibly made with a financial assistance of ASER.

In addition, with increasing needs for capacity expansion for refrigerator and colour-TV, the development will be developed from lighting-oriented electrification, to productive-use electrification, finally to the rural development. Now Mar Island is in the entrance of the next stage of Process (2) as shown in Annex Chart A4-2 (2), that is, from "No linkage between the village and the private business entity" (Process (1) as shown in Chart A4-2 (1)) to "Establishment of linkage between the village and the private business entity" (Process (2)).

The subsequent development will fully depend on both the development desire and needs of the rural community/rural population and the business strategy of the private entity. This is really market economy. But such development in Mar Island will require more technical and financial support. This support should be provided as a part of, or in relation

to continuous monitoring of the pilot project and for diffusion of global rural electrification as mentioned before, focusing on institutional aspect of community empowerment.

In due consideration of the above-mentioned circumstances, during the 5 year period of the management contract, various changes will inevitably occur in Mar Island. It is expected that such changes will be induced by the operator/private business entity. It should be well understood by rural population that such changes be a part of the process to self-sustainable socio-economic society. This 5 year period will be a very important time for the rural community, because reliable and firm linkage with the private business entity has been established and there is some technical and financial support from ASER.

Taking this opportunity, the rural community should try to change the current operation and management system (Pilot Project Stage 1-1 as shown on Chart 4.2) to the community initiated operation and management system (Pilot Project Stage 1-2 as shown in Chart 4.3) where the fund management be taken care of by the village users association (VUA). Naturally, repair of serious troubles and renewal of the components such as batteries, charge controller, etc. shall be carried out by the present operator under the contract of "Repair and Renewal", subject to ASER's approval. It goes without saying that this will require the positive cooperation of the Operator.

At the same time, it is also a part of technical support of ASER that financial mechanism, as shown in Chart 4.4, should be arranged to function properly in order to make the rural population have an access to term loan.

### **Importance of Pilot Project for Global Rural Electrification**

In order to make practical the Business Model proposed in this chapter, it is strongly advised to provide additional inputs as mentioned above, technically and financially, to the Pilot Project and monitor the development. In addition, continuous monitoring will be significant as a part of public relation of ASER in introducing and inviting village population in non-electrified villages to Mar Island as a Model Village for the global rural electrification.

### **Fund Management for Pilot Project**

As shown in Chart 4.5, some amount of the tariff increase will be inevitable when the renewal of batteries take places, say 4 years after the installation, depending on the result

of the performance of operation and maintenance before the renewal date. In due consideration of these matters, it is strongly recommended to hold regular meeting between ASER and the Operator, every 4 months, where the accounting report and O & M report be presented and compared with the Chart 4.6. The details of the past performance for the Pilot Project is presented in Annex B.

## **(2) Project Formation**

It could be understood that the rural electrification, whether lighting-oriented or productive use, be a step to the future self-sustainable socio-economic community. Truly, the development of a self-sustainable socio-economic community is itself a result of major socio-economic impact of the PV rural electrification. In this context, the Business Model has been constructed and will require modifications with the progress of real project implementation. The Business Model, consisting of "Project Formation" and "Financial Model", the concept of which is not limited to PV rural electrification, should be at this moment recognized as a *first step toward the arrangement of the public-private initiative rural electrification market.*

It is highly expected that the final Business Model be produced through more dialogue between the government officials representing ASER and MMEH, and private business enterprises interested in this challenging scheme. It is also expected that the building of institutional capacity of ASER be attained through this process. There are many parameters to be fixed prior to project implementation, which are tentatively defined in the Business Model. These matters should be discussed and commonly understood among the above parties concerned, which are expected to take major risks and responsibilities for the performance as well. This process is very important at this moment, particularly for ASER. This is the major objective to propose the Business Model.

We believe that the construction of Business Model recognized by the parties concerned could be a starting point toward the arrangement of the public-private initiative rural electrification market and a break down of the dilemma retained by the potential private operators. In parallel with the limited open tendering for the selection of the consultants pursuing PLE, it is advised to construct the Business Model at the earliest possible time under the initiative of ASER. After that, through implementing the actual project, the staff of ASER will recognize the gap between the parameters adopted in the Model and the reality, and feed back the results to the Model. Such kind of experience by the staff of ASER, will significantly contribute to the institutional building and management

capability of ASER. Therefore, it will be tremendously important for the staff of ASER to be continually engaged in this institution.

The basic pre-conditions for the project formation is presented as below.

### **Basic Pre-conditions for Project Formation**

1. Concession : 20 years

2. Initial 10 Years (Chart 4.7)

The Operator is fully responsible for the implementation, operation, and management of the PV system and fund management as well. The Operator is responsible for user education (\*1) on how to use the electric appliance properly, referring to the users' manual. In addition, Local Technician will be trained so as to be PV Expert by giving an opportunity to the former to get more advanced training course in Dakar. Trained local technician will be employed as PV Expert by the Operator for another project. At the same time, another Local Technician will be trained for the daily operation and maintenance for the next 10 years.

\*1 Consumer Awareness and Cost reduction

User education is essential for PV program success. Information and training in simple maintenance and safe operating procedures (including suitability of electric appliances) should be targeted to those persons in the households who will have primary responsibility for the system. Users need to understand that good operating practices minimize recurring costs and enhance battery life.

3. Second 10 years (Chart 4.8)

The agreement on "Repair and Renewal" between the Operator and VUA will be reached under the approval of ASER. At the same time, the fund management will be transferred to VUA. This transfer of the management system will take place only under such condition that the good and reliable partnership has been established and mutually recognized by both parties, but subject to approval of ASER.

### **(3) Financial Model**

The major and minimum conditions for construction of the Financial Model, is as follows;

- Tax exemptions: VAT, import duties\*<sup>2</sup>, income tax, etc.
- Fund source for subsidy and loan

- Role and responsibility of the parties concerned (See the matrix below)

\*2 Import Duties

Import duties are imposed on PV component. Therefore, the initial cost adopted in the financial model includes import duties.

	ASER	Private Entity	Rural Community (VUA)
ASER	-	-	Monitoring
Private Entity	Transparent accounting	-	Provision of quality service
Rural Community (VUA)	-	Fee for service	-

To practice the above simple principles, it should be again reminded that the reliable relationship, or good partnership, should be firstly created among the parties concerned in the pre-implementing stage, including public consultations (socio-economic survey, explanation of contents of service, tariff, payment method, etc.), and in the implementing stage (installation of PV system)

Referring to the Project Formation discussed in the previous section, the Financial Model has been constructed, in due consideration of Chart 4.9 and the following conditions.

**Evolution of Project Formation**

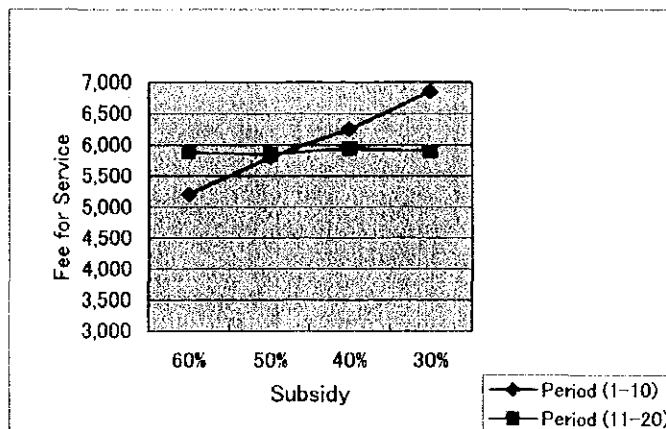
	Initial 10 years	Second 10 years	After 20 years
Concession	Private Entity	Private Entity	Private Entity
Ownership of PV system	Private Entity	VUA (ASER)	VUA (ASER)
Fund management	Private Entity	VUA	VUA
O&M	Private Entity	VUA	VUA
Repair and Renewal	—	Private Entity <sup>*1</sup>	Private Entity <sup>*1</sup>

The summary on “Monthly Payment versus Subsidy Rate” is shown as below.



**Subsidy v.s. Fee for Service**  
**(300 Units)**

300	Units		ROE	Cash Position after 20 years
	Period (1-10)	Period (11-20)		
60%	5,200	5,876	15.5%	1.6
50%	5,800	5,850	17.7%	4.8
40%	6,250	5,938	17.4%	0.1
30%	6,850	5,891	19.6%	0.5



The summary table for the financial analysis with sensitivity analysis is shown in Chart 4.10.

The financial model in case of subsidy rate of 50% and subscribers number of 500, is presented in Chart 4.11.

The pricing structure and the expense stream for O & M is shown in Chart 4.12.

The results of sensitivity analysis are shown as below.

**Sensitivity analysis**

<b>Initial Cost</b>		<b>Fee</b>	
450,000	CFA/system	5,800	CFA/month
400,000	CFA/system	5,400	CFA/month
<b>System</b>			
<b>Units</b>		<b>Fee</b>	
300	Units	5,800	CFA/month
330	Units	5,700	CFA/month
270	Units	5,900	CFA/month
<b>Deposit %</b>		<b>Fee</b>	
80%		5,858	CFA/month
60%		5,900	CFA/month
<b>Operator's Equity</b>	<b>Up to 10</b>	<b>11 to 20</b>	
	<b>Fee</b>	<b>Fee</b>	
20%	5,800	5,800	CFA/month
30%	5,700	5,871	CFA/month
<b>Operator Profit %</b>			
5%	5,700	CFA/month	
3%	5,500	CFA/month	
<b>Fee Collection Rate in %</b>			
100%	5,800	CFA/month	
95%	6,100	CFA/month	
90%	6,450	CFA/month	

Several matters considered for construction of the Business Model are itemized below.

**1) First priority on provision of quality service**

- Quality service is equal to satisfactory fee collection
- It is recognized among the Senegalese persons involved in this project that the reliable relationship among Supplier/Operator, ASER/MMEH/JICA, VUA, was established in the pre- and PV installation stage. This fact, not exaggerated, should be recognized and appreciated particularly by the Senegalese people. This has been a critical factor to the success of the pilot project. Among others, the fact of providing the rural population with good quality service and collecting the fee in a satisfactory manner is itself a fruit of efforts of the people engaged in this project.

## 2) Selection of target village and target users

- High capacity to pay = High income level
- Priority on households with high energy expenses and high income level (Upper 20 to 25 % high income level, ranged between 5,000-6,500 CFA/month)
- Well-organized villages

## 3) Awareness of rural population

- Payment period of 20 years appears to be too long.
- User education is essential for PV program success. Information and training in simple maintenance and safe operating procedures should be targeted to those persons in the households who will have primary responsibility for the system. Users need to understand that good operating practices minimize recurring costs and enhance battery life.

## 4) Importance of Village Organization

The target for service provision by rural electrification is rural population as end-users. In considering future economic development of the village as a whole, it is recommendable to define the minimum unit for management, the association organized for specific purpose like VUA in Pilot Project, not the individual household, from such viewpoints community empowerment (local capacity building), project implementation, creation of reliable relationship among people concerned. Therefore, the problem on gap between electrified and un-electrified people generated by the project shall be internally dealt with by VUA, not by the operator and the outside institutions of ASER and others. Toward a self-sustainable socio-economic society, from the outset, the rural community should be motivated to community empowerment through project implementation.

## 5) Renewal of PV components

Small renewable energy (mini-power) systems employ a variety of technologies and vary in generating capacity. They range from solar PV systems that can produce electricity for a single family to wind-powered irrigation systems shared by groups of farmers. With recent advances in technology and continuing reduction in prices,

mini-power systems are now available to millions who have little opportunity to be connected to national grids.

The trend of reduction in price may be probable, but the financial model is conservatively designed with no cost reduction in price of PV components such as batteries and charge controller, etc. Tariff adjustment due to this effect will be made at the time of tariff reviewing every 2 years, where the price available at the time be reflected in calculation.

#### **4.3 Assignments for ASER to Proposed Business Model**

As discussed in the previous section, the following matters are significantly important for proceeding to PV rural electrification under the public-private sector initiative:

- Establishment of reliable partnership between the operator and rural population
- Transparent fund management
- Clarification of profitability for the operator
- Users' education of daily operation and maintenance, related to community empowerment

Once the advantages of electrification, even lighting-oriented, are recognized by population, further needs for electrification, say new customers or capacity increase, will come out, resulting in creation of more business opportunity. In this respect, the operator is advised to take a proper action responsive to such needs of the population. This depends on the marketing of the private sector. Through such process, market economy will gradually penetrate into rural community.

In due consideration of the above ideas, more discussion among the parties concerned is strongly advised to be done under the initiative of ASER, on the matters as listed on Chart 4.13, for making the Financial Model more practical. At the same time, the following matters as well should be taken up for discussion, among which due consideration be given to population's needs, willingness to pay, capacity building of rural community, etc.

### **(1) Basic Pre-conditions for Financial Model**

The financial model has been constructed to make the accumulated cashflow positive through the concession period and to secure the cash necessary for renewal of all the components at the end of the concession period. (Minimum requirements for financially sustainable management)

### **(2) Willingness to pay**

Many rural people can pay for renewable energy systems without increasing their present monthly expenditure and receive much higher quality services. It is strongly advised to carry out the socio-economic survey, focusing on monthly energy expenditures, quality of service to be provided by PV, and advantages of PV electrification in term of lead time in comparison with the grid extension, etc.

### **(3) Process of economic development through local institutional building**

The issue of productive uses has not been addressed, but they are not being ignored in this model. It is noted that the analysis of a project in an African country confirms that the process of electrifying rural households had an immediate impact on the economic development of the village. Therefore, we believe that some local economic development will result from the initial electrification initiative.

### **(4) Rural Community Empowerment — Linkage to private business entity -**

The community organization jointly chooses an individual to act as local agent for the system supplier. This individual will undergo one week of training at a local vocational training center on operation and maintenance of the system. The cost of this training is to be covered by the system supplier and will therefore be included in the system price. This individual will serve as the link, say as a “coordinator”, between the supplier and the village, stocking spares, identifying new opportunities, and also collecting payments for the operator.

In addition, as people become more aware of the potential of the technology, it is expected that there will be a demand for more systems to support local development. The organizational base for the collective action, which has been developed through the household lighting system, will make it possible to support the increased demand. Through the training programs, credit mechanisms, and increased government awareness and social acceptance of these technologies, these programs will expand into the direct

economic development arena. Once it is established that rural communities can take part in the formal economic structure, with an understanding and acceptance of credit options, the goal of community empowerment will be achieved. Eventually the rural community could be transformed to a self-sustainable society.

#### **(5) Evolution of business partnership for socio-economic development in Mar Island**

In the coming 5 years, the major propositions addressed in the Business Model could be made clear with adequate inputs such as finance to meet the waiting subscribers and to utilize the surplus capacity of the existing well pumping facility in Mar Islands. This process is advised to be verified by evolution of the subsequent business activities there, which will depend on development of the mutual business partnership between the operator and VUA/village population. The development will grow under such a market economy, where the needs, the willingness to pay should be in cope with market price proposed by the operator.

#### **4.4 Recommendations**

ASER is now tackling a challenging and urgent task for the market arrangement for public-private initiative rural electrification. To facilitate the task, we would like to recommend the following three (3) recommendations, where the priority be placed in order of numbering.

##### **(1) Regular dialogue with the private sector**

“The private sector needs to be recognized as a critical partner in rural development, if we hope to accelerate the pace at which rural people can obtain access to energy services.”

More dialogue will be required at this moment to be held in order to make more practicable the Financial Model proposed in the previous section, which fund source for subsidy and loan shall be clarified to the private sector.

## **(2) Global Campaign for Rural Electrification**

Few renewable energy equipment and service suppliers are aware of the tremendous potential of millions of customers who have little contact with the formal market economy. Communities, NGOs and local entrepreneurs can aggregate this demand to attract suppliers of much-needed services.

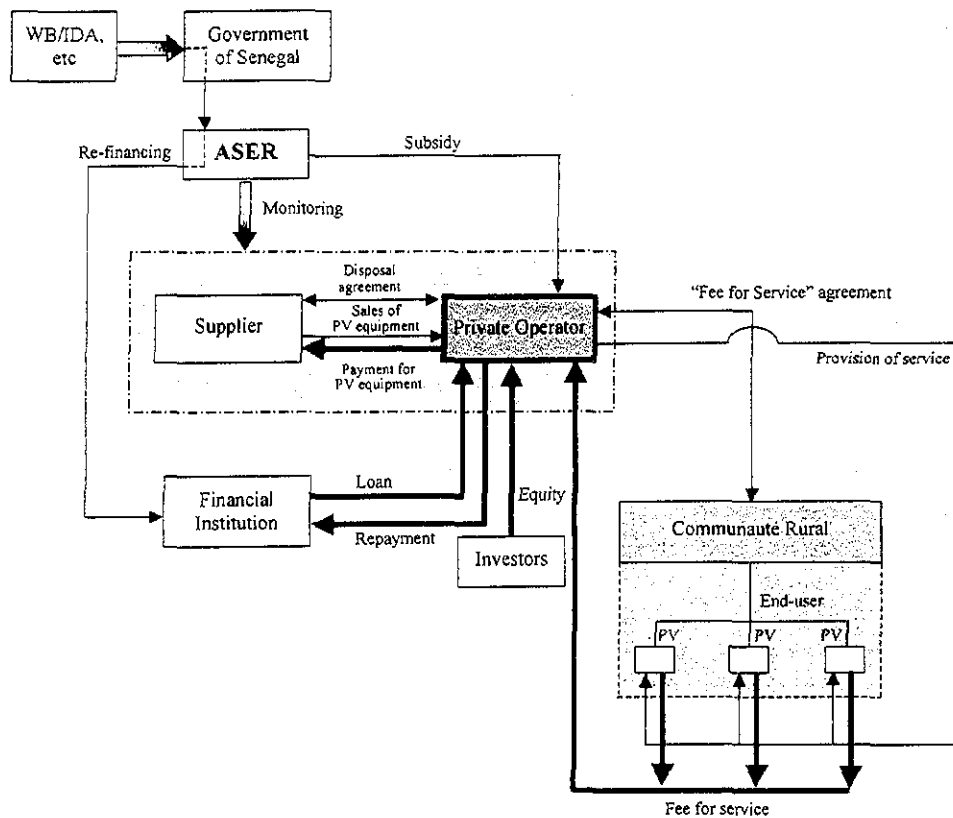
It should be noted that access to electricity has become easier by implementing lighting-oriented electrification in Mar Island, where the communication pipe has been established, connecting the rural community to the private business entity located in Dakar. This indicates that the reliable relationship which was already established will be continued so as to contribute to further economic development. It also depends on population's desire and needs for development and business interests of the private sector. In constructing of financial model, such future business opportunities should be well taken into consideration, in relation to the profitability of the operator. That is why more dialogue between ASER and the private sector will be required at this moment. The global campaign should be carried out after mutual understanding between ASER and the private sector was ensured.

## **(3) Early execution of a real project under the initiative of ASER**

Conventional rural electrification programs are often mired in stagnant institutional model, which ignores the individual and social behavioural patterns of the rural population. In this respect, the continuous monitoring in Mar Island will be useful in learning such social behavioural patterns. Through direct contact with the rural population, the results of the survey will be also fed back to other projects. The survey could be started from the standpoint of the rural population, in other words, the demand-side approach. Through this kind of process, particularly in the present initial stage, all the staff of ASER will be advised to have common viewpoints, paying due attention to the awareness of the rural population. That is why replacement of the staff shall be avoided as much as possible.

**Chart 4.1 Business Model (Draft) Total Management by Private Operator under Local Community Initiative**  
**(PPER: Program Prioritaire d'Electrification Rurale)**  
**(ERIL: Electrification Rurale d'Initiative Local)**

(Concession Period: 20 years)



**Development Concept**

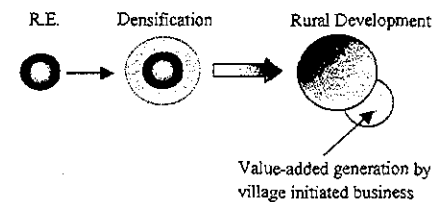




Chart 4.2 Business Model – Project Formation – Operation and Management System for Pilot Project

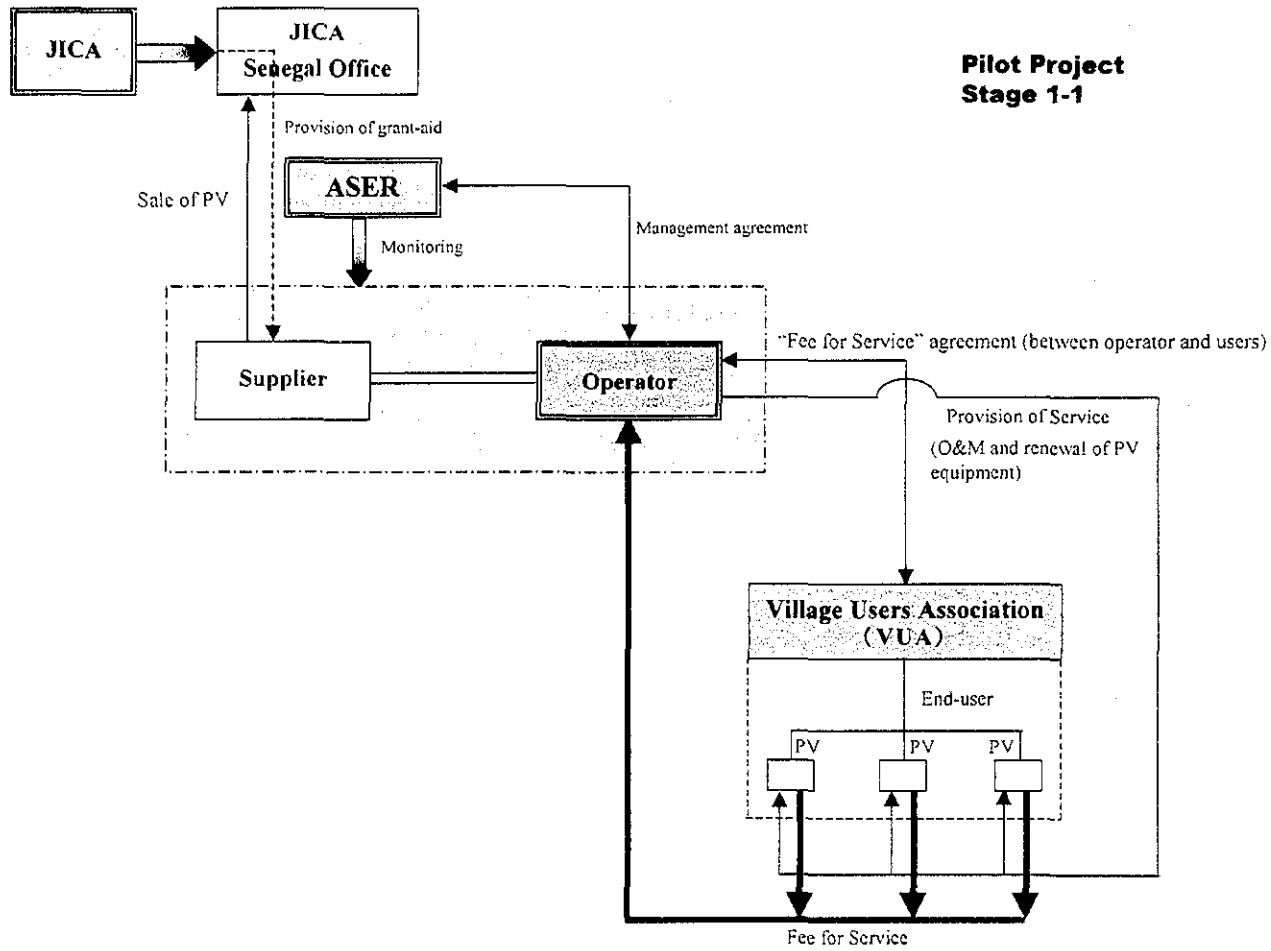


Chart 4.3 Business Model – Project Formation – Operation and Management System for Pilot Project

**Pilot Project  
Stage 1-2**

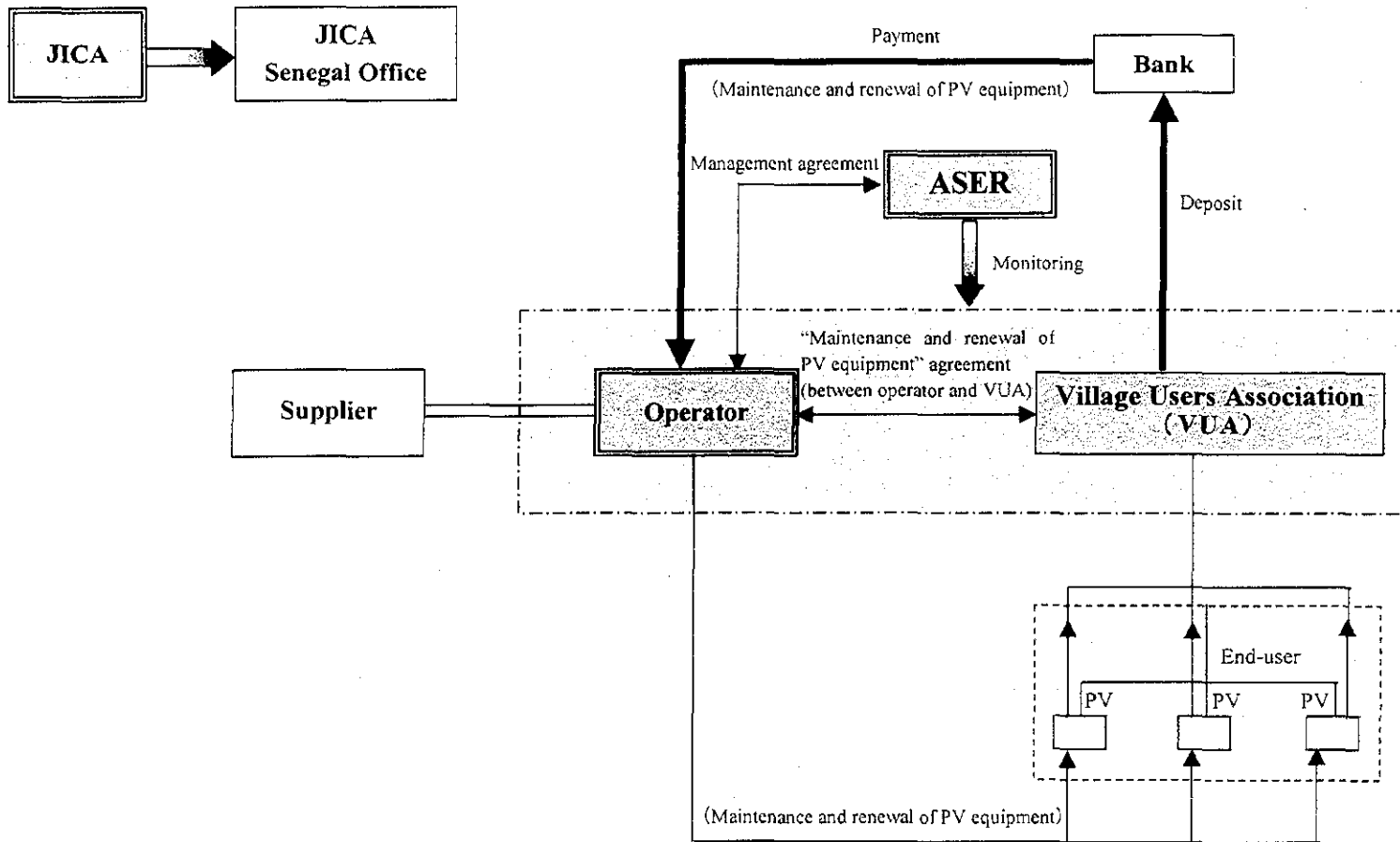


Chart 4.4 Fund Circulation Mechanism

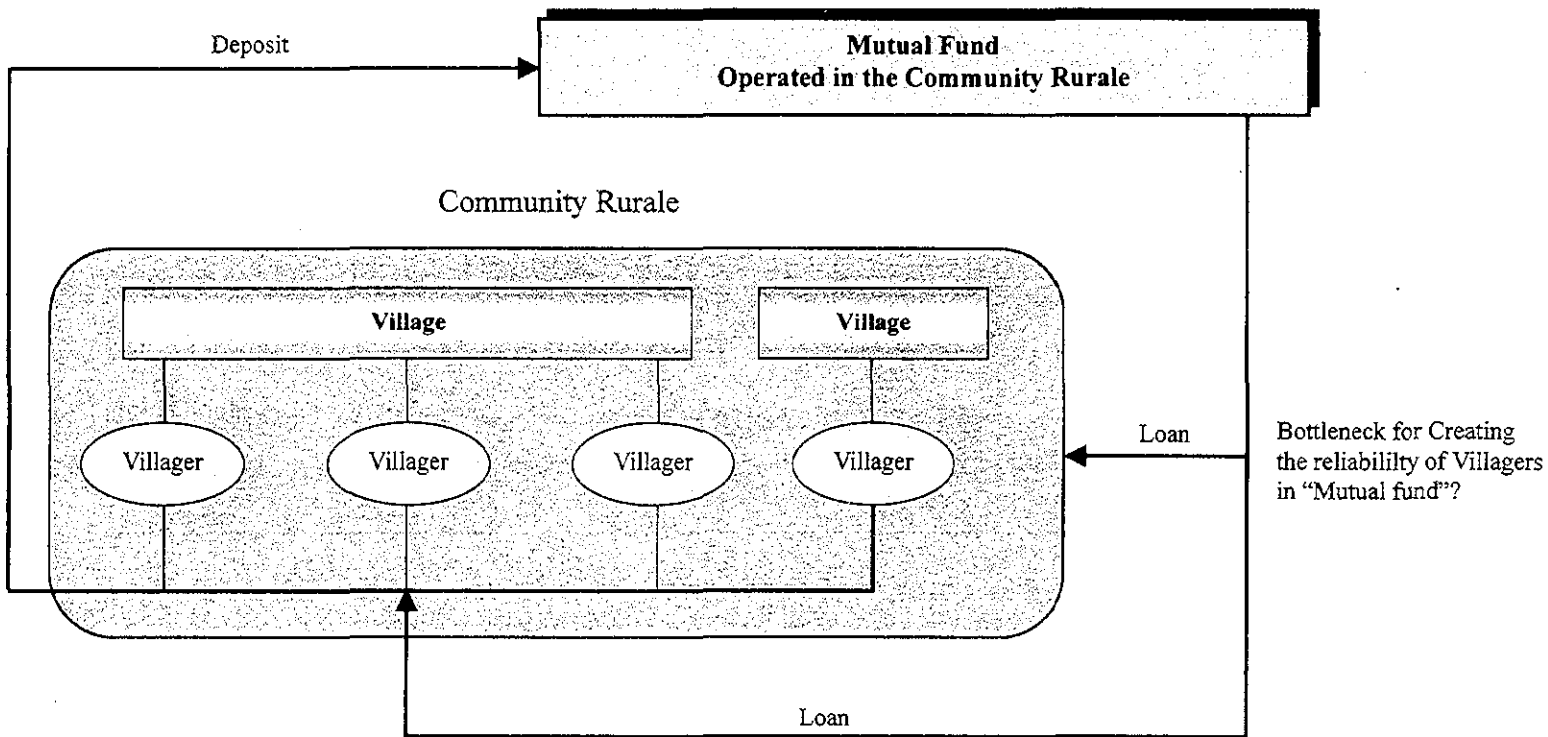
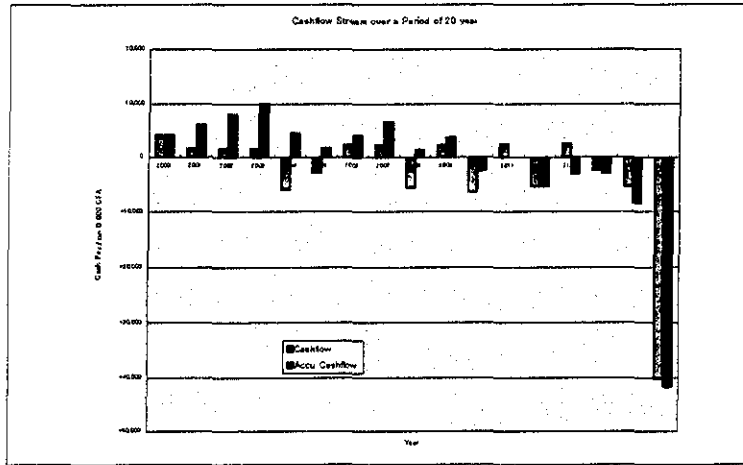


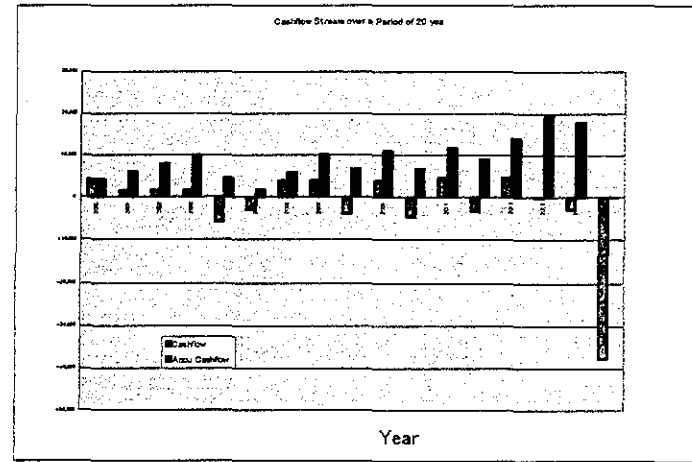
Chart 4.5 Cash Flow Stream over a Period of 20 years  
- Fund Management for Pilot Project -

**Case 1 No Tariff Increase**



Tariff Setting	CFA/month
up to 2005	3,700
up to 2010	3,700
up to 2015	3,700
up to 2020	3,700

**Case 2 Tariff Increase for Sustainable Management**



Tariff Setting	CFA/month
up to 2005	3,700
up to 2010	5,180
up to 2015	5,550
up to 2020	5,920

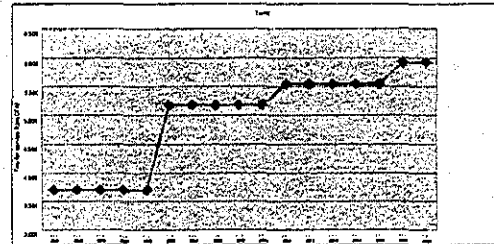
**Chart 4.6 (1) Financial Management for Pilot Project**

**Chart B Financial Plan for Implementation of Pilot Project**

(Before the implementation of the project)

Major Assumptions (1,000 FCFA)

- 1 System Unit Cost (55 Wp) **450** (1,000 FCFA) Monitoring items
- 2 Administration Cost for Private Operator (PMC)
- 3 Management Cost for Village Community (PMO)
- 4 Financial Conditions
  - Initial Investment Cost **45,000** 0.07 US\$ mi., inclusive of HTV
  - User's contribution 9.5% 4,275 x 1,000 CFA
- 6 Revenues
  - 45,000 FCFA For initial subscription fee which may be regarded as "User's Contribution"
  - 3,700 FCFA/Unit/month For monthly service fee



105 Minimum accu. Cashflow over a period of 20 years  
105 Cash position after 20 years after reduction of replacement cost

Tariff Setting			
up to 20	up to 20	up to 20	up to 2020
3,700	5,180	5,550	5,920
40%	50%	60%	

7 No. of Subscribers	95 Units																			
8 Depreciation	(US\$ = 650 FCFA)																			
FCFA/System		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020		
Depreciation		4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646		
9 Projection of Income		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020	
Price		3,700	3,700	3,700	3,700	3,700	5,180	5,180	5,180	5,180	5,180	5,550	5,550	5,550	5,550	5,550	5,920	5,920		
Revenue		4,218	4,218	4,218	4,218	4,218	5,905	5,905	5,905	5,905	5,905	6,327	6,327	6,327	6,327	6,327	6,749	6,749		
Expenses		2,352	2,352	2,352	2,016	2,016	1,680	1,680	1,680	1,680	1,680	1,440	1,440	1,440	1,440	1,440	1,440	1,440		
Contingency for community empowerment		214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214		
Gross Profit	0	1,652	1,652	1,652	1,988	1,988	4,011	4,011	4,011	4,011	4,011	4,673	4,673	4,673	4,673	4,673	5,095	5,095		
Depreciation		4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646		
minus Replacement		0	0	0	7,885	4,940	0	0	7,885	0	8,740	0	7,885	0	0	4,940	7,885	42,750		
PV Module (Wp)	180,000																		17,100	
Charge controller (A)	40,000																		3,800	
Battery (Ah)	83,000																		7,885	
Ballast Inverter Lamps	52,000																		4,940	
Pole, Cable, etc.	60,000																		5,700	
Installation, Transport	35,000																		3,325	
4.25% (Max. Mutual Fund Interest)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020		
Net Cashflow	4,275	1,652	1,652	1,652	-5,897	-2,952	4,011	-3,874	4,011	-4,729	4,673	-3,212	4,673	4,673	4,673	-267	-2,790	-37,655		
Accu. Cashflow	4,275	5,927	7,579	9,231	3,335	363	4,394	8,406	4,532	8,544	3,815	8,488	5,277	9,950	14,623	14,356	11,567	-10,803		
Accu. Cashflow with Interest	4,275	6,109	8,020	10,014	4,542	1,784	5,871	10,132	6,689	10,985	6,723	11,682	8,967	14,021	19,290	19,843	17,897	105		

Year 2001: Opening of Bank A/ Year 2005: Re-negotiation of Management Contract  
 Year 2003: Review of O & M Cost  
 Year 2004: Review of Fund Management

Chart 4.6 (2) Financial Management for Pilot Project

Chart A Table of Cost Control for the Pilot Project

(For the methodology of financial analysis of the project ERLL)

Fee for service	3,700	CFA/month	No increase in tariff	
	2001	3,700	CFA/month	
	2006	5,180	CFA/month	
	2011	5,350	CFA/month	

Monthly Expenses for O & M of the Pils (excluding renewal cost)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
C Local Technician		40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
D External Technician		80,000	80,000	80,000	60,000	60,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
F Transportation		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
40% (C+D+F)=G Miscellaneous		56,000	56,000	56,000	48,000	48,000	40,000	40,000	40,000	40,000	40,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
The % should be determined at discretion of the Operator in charge.	Total (CFA/month) (Estimation)	196,000	196,000	196,000	168,000	168,000	140,000	140,000	140,000	140,000	140,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000	120,000
	CFA/yr (Estimation)	2,352,000	2,352,000	2,352,000	2,016,000	2,016,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000	1,440,000
	CFA/yr (Actual)	2,255,040																			
	CFA/mo (Actual)	187,920																			

Estimation of Cash Position during Operation & Management	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Net Cashflow	4,275	1,652	1,652	1,652	-5,897	-2,952	4,011	4,011	-2,874	4,011	-4,729	4,673	-3,212	4,673	4,673	-267	-2,790	5,095	5,095	5,095	-37,655
Accumulated Amount	4,275	5,927	7,579	9,231	3,335	383	4,394	8,406	4,532	8,544	3,815	8,488	5,277	9,950	14,623	14,356	11,567	16,662	21,757	26,852	-10,803
4.25% related Amount with saving effect	4,275	6,109	8,020	10,014	4,542	1,784	5,871	10,132	6,689	10,985	6,723	11,642	8,967	14,021	19,290	19,843	17,897	23,752	29,837	36,221	105
Actual Cash Position	4,275																				

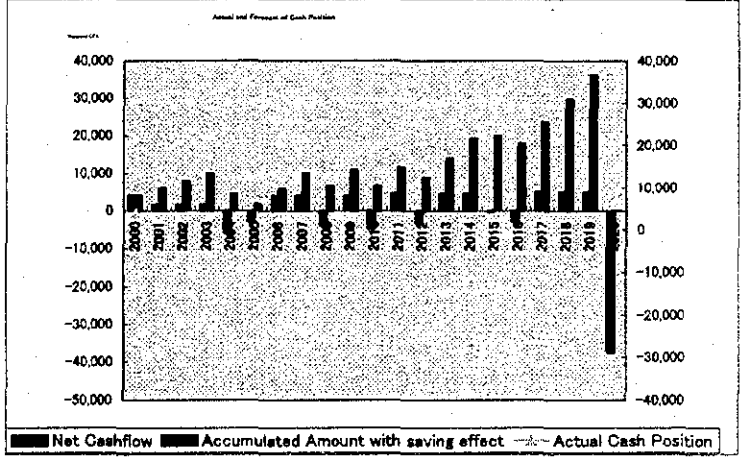
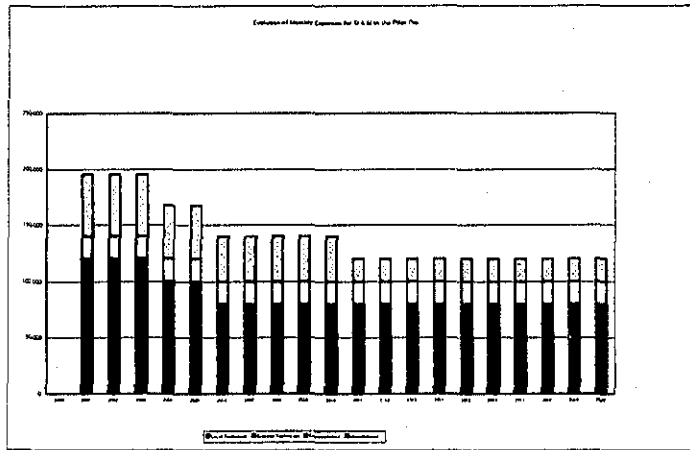
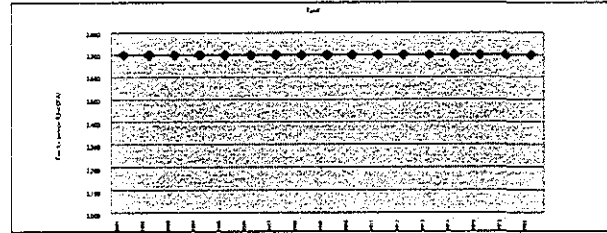


Chart 4.6 (3) Financial Management for Pilot Project

Chart B Financial Plan for Implementation of Pilot Project  
(Before the implementation of the project)  
Major Assumptions (1,000 FCFA)

- 1 System Unit Cost (55 Wp) 450 (1,000 FCFA) Monitoring items
- 2 Administration Cost for Private Operator (PMC)
- 3 Management Cost for Village Community (PMO)
- 4 Financial Conditions
  - Initial Investment Cost 45,000 0.07 US\$ milli, inclusive of HTV
  - User's contribution 9.5% 4,275 x 1,000 CFA
- 6 Revenues
  - 45,000 FCFA For initial subscription fee which may be regarded as "User's Contribution"
  - 3,700 FCFA/Unit/month For monthly service fee



-41,732 Minimum accu. Cashflow over a period of 20 years  
-41,732 Cash position after 20 years after reduction of replacement cost

Tariff Setting			
up to 200	up to 201	up to 201	up to 2020
3,700	3,700	3,700	3,700
0%	0%	0%	0%

7 No. of Subscribers	95 Units	8 Depreciation (US\$ = 650 FCFA/System)	9 Projection of Income																	84,360	
			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020		
		Depreciation	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	
	2000	Price	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	3,700	
		Revenue	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218
		Expenses	2,352	2,352	2,352	2,016	2,016	1,680	1,680	1,680	1,680	1,680	1,680	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440
		Contingency for community empowerment	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214
		Gross Profit	0	1,652	1,652	1,988	1,988	2,324	2,324	2,324	2,324	2,324	2,564	2,564	2,564	2,564	2,564	2,564	2,564	2,564	2,564
		minus Depreciation	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646	4,646
		Replacement	0	0	0	7,885	4,940	0	0	7,885	0	8,740	0	7,885	0	0	4,940	7,885	0	0	17,100
		PV Module (Wp)	180,000																		17,100
		Charge controller (A)	40,000																		3,800
		Battery (Ah)	33,000			7,885				7,885		3,800		7,885						7,885	39,425
		Ballast Inverter	52,000				4,940					4,940					4,940				19,760
		Lamps	60,000																		5,700
		Pole, Cable, etc.	60,000																		3,325
		Installation, Transport	35,000																		3,325
### (Max. Mutual Fund Interest)	2000	Net Cashflow	4,275	1,652	1,652	-5,897	-2,952	2,324	2,324	-5,561	2,324	-6,416	2,564	-5,321	2,564	2,564	-2,376	-5,321	-40,186	-42,438	
		Accu. Cashflow	4,275	5,927	7,579	9,231	3,335	383	2,707	5,031	-529	1,795	-4,621	-2,057	-7,377	-4,813	-2,249	-4,625	-9,945	-42,438	
		Accu. Cashflow with Interest	4,275	6,109	8,020	10,014	4,542	1,784	4,184	6,686	1,409	3,793	-2,461	-1	-5,322	-2,984	-547	-2,946	-8,392	-41,732	

Year 2001: Opening of Bank A/C & Int Year 2005: Re-negotiation of Management Contract

Year 2003: Review of O & M Cost

Year 2004: Review of Fund Management

**Chart 4.7 Business Model – Project Formation -  
ERIL: Electrification Rural d'Initiative Local**

**(Stage 1)**

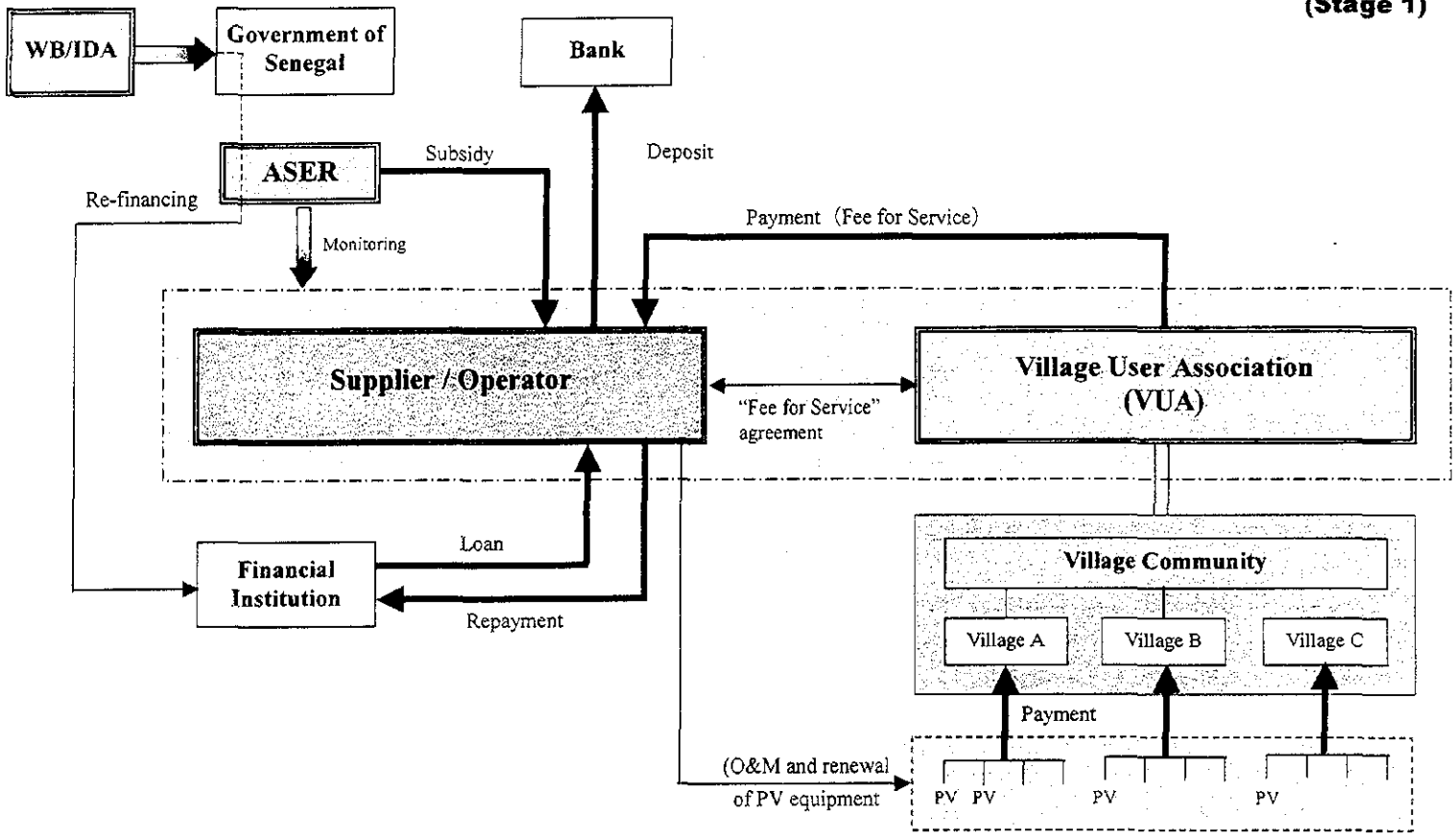
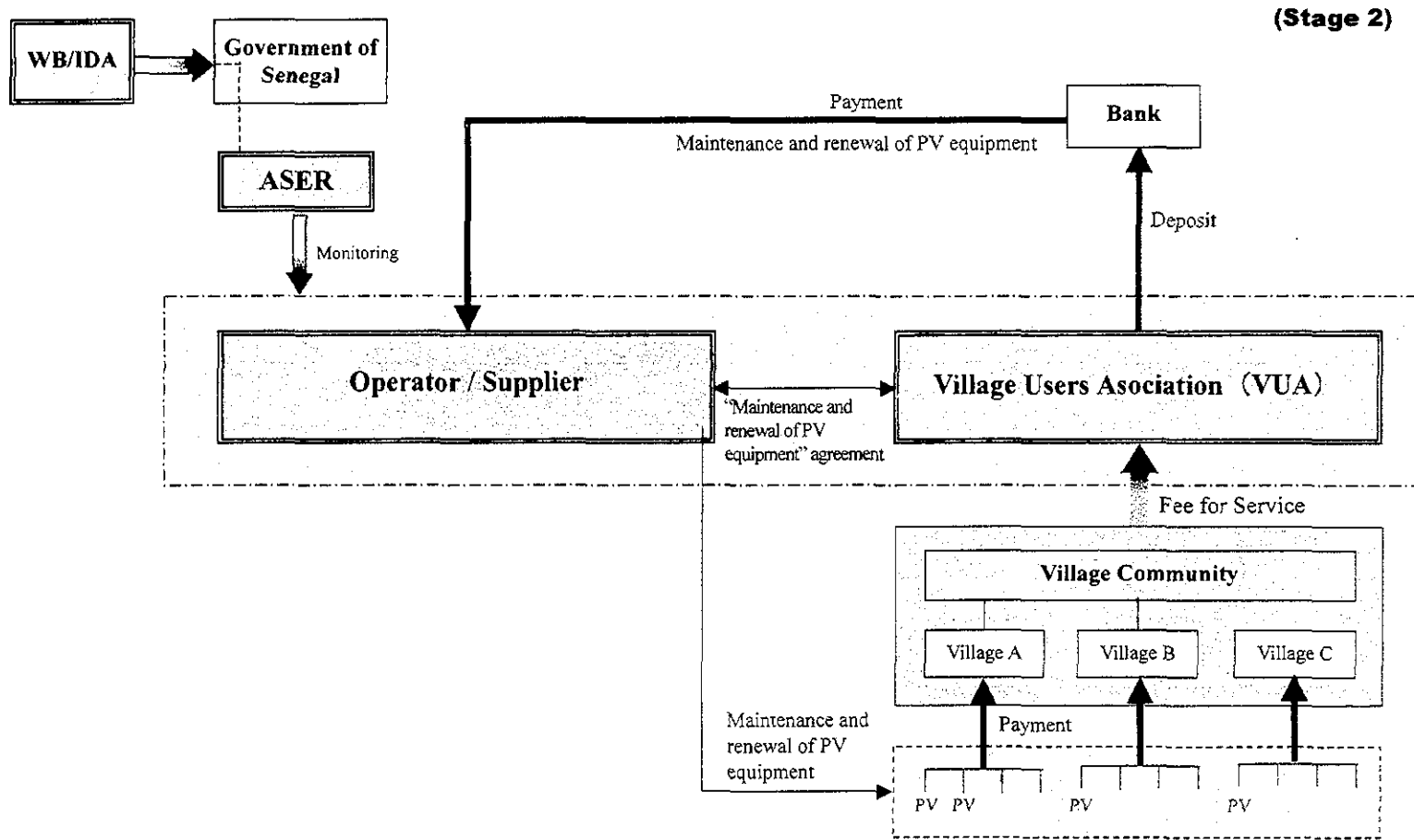




Chart 4.8 Business Model – Project Formation -  
ERIL: Electrification Rural d’Initiative Local



**Chart 4.9 Pre-conditions for Financial Model**

<b><u>Minimum Requirement</u></b>	
1. Concession	
• Period 20 years	
2. Local population	
• Initial payment	: More than 10% of the initial investment
• Monthly payment	: 5,000 CFA to 6,500 CFA in the initial 5 years (depending on the income of population and energy expenses in the respective rural community through the socio-economic survey)
3. Potential operator	
• Equity portion	: Not less than 20%
• Provision of good quality service	
• Concession period	: 20 years
• Fund management	: Secure the cashflow sufficiently enough to replace the equipment after 20 years
4. Government represented by ASER	
• Sustainable financial assistance	: Secure the enough fund for subsidy, refinancing, guarantee fund, etc. to meet the adequate profitability of the operator in term of ROE (return on equity), saying 15-20%.
• Appropriate establishment of PV training facilities	
• Tax exemptions	: Special legal decree applied to the rural electrification, such as income tax, VAT, etc.
<b><u>Conditions for Financial Model</u></b>	
1. PV System	
• Capacity: 55 Wp	
• System unit cost: 450,000 CFA	
• 300 units	
2. Renewal of PV components	
• PV Module	20 years
• Charge controller	10 years
• Battery	4 years
3. Financial Targets	
• ROE =15 to 20 %	
• Cash position after 20 years > the amount required to replace the necessary components	
4. Major Parameters	
• Subsidy rate be ranged between 30% and 60%	
• Increase % in tariff after 10 year will be determined depending on the cash position and future cashflow forecast, subject to the clause of the contract	
5. Outcome	
• Monthly payment be ranged between 5,000 CFA and 6,500 CFA	

### Chart 4.10 Operation and Management by the Operator over a period of 10 years

Operation & Management by the Operator over a period of 10 years and by VJA over a remaining period of 10 years

Chart 1 Summary Table

General Pre-Conditions		
System Unit (\$5 Wp)	300	Units
System Unit Cost	450,000	CFA
Replacement Cost	27.6	Million CFA after 10 years' operation

Fee for Service			
Period (Year)	Up to 5	6 to 10	11 to 20
Tariff (CFA/month)	5,800	5,858	5,858
		1%	1%

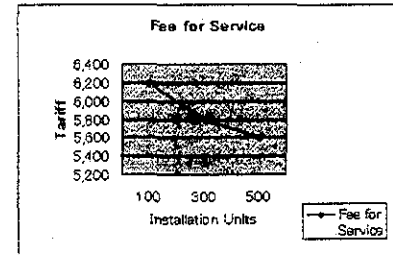
Initial Payment	
45,000	CFA/Unit

Replacement cost secured after 20 years

Case Study		Cash Position		Liquidation Amount
Subsidy Rate	ROE	After 10 years	After 20 years	
50% Case 1	13.8%	5.9	Million CFA	44.0 Million CFA
Operator's Group	17.7%	4.8	Million CFA	

Summary Results

- Assumption 1 : 50,000 CFA/system be secured at the time of sale for the operator
- Assumption 2 : 5% for equity be secured for 10 years' operation
- Assumption 3 : Renewal cost after 20 years' operation be secured



50%	5,800	5,858	17.7%	4.6
-----	-------	-------	-------	-----

300 Units	ROE	Cash Position		
Period (1-10)	Period (11-20)	after 20 years		
60%	5,200	5,876	15.5%	1.6
50%	5,800	5,858	17.7%	4.6
40%	6,250	5,898	17.4%	0.1
30%	6,850	5,881	19.5%	0.5

500 Units	ROE	Cash Position		
Period (1-10)	Period (11-20)	after 20 years		
60%	5,050	5,808	15.3%	1.1
50%	5,800	5,858	17.7%	4.6
40%	6,150	5,843	17.8%	1.7
30%	6,700	5,863	19.5%	2.1

100 Units	ROE	Cash Position		
Period (1-10)	Period (11-20)	after 20 years		
60%	5,600	6,384	15.1%	0.7
50%	6,200	6,358	17.7%	4.6
40%	6,700	6,365	17.6%	0.1
30%	7,300	6,351	20.0%	0.7

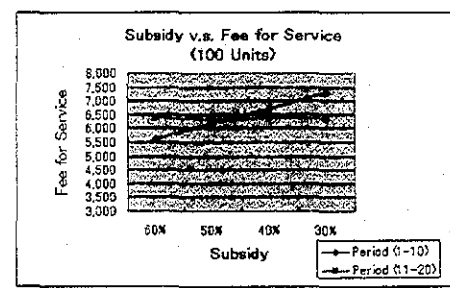
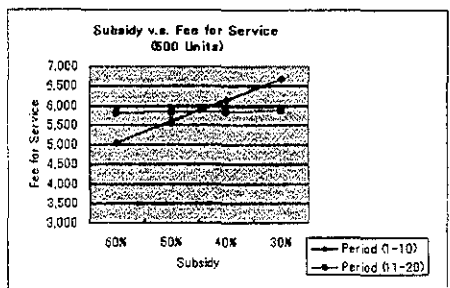
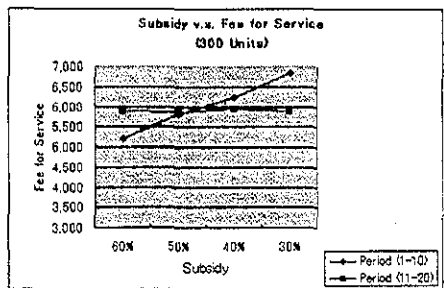


Chart 4.11 (1) Financial Business Model for PV Rural Electrification

1 Financial Business Model for PV Rural Electrification

1 English, 0 French

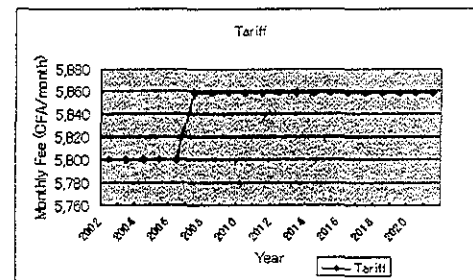
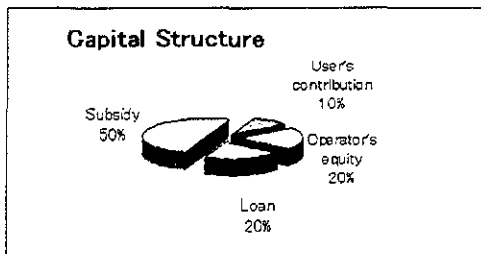
Pre-Conditions

K 1 System Unit Cost (55 Wp) **450** (1,000 FCFA)

F, G 2 O & M Cost for Private Operator See "O & M and Renewal"

K, J 3 Capital Structure

Initial Investment Cost	135,000	0.21	US\$ million
User's contribution	10%	13,500	
Operator's equity	20%	27,000	
Loan	20%	27,000	
Interest	7.0%		
Repayment	5,400 x 1,000 CFA/year		
Grace period	5 years		
Repayment period	10 years		



4 Others

30%	<b>Subsidy 50%</b>	67,500	ROE = <b>13.9%</b>	Amount (= Subsidy + Loan) over a period of 10 years for the operator's profitability	15,000	Profit at sales
			ROE = <b>17.7%</b>	over a period of 20 years for the operator's profitability without liquidation		

FIRR = **NRUM**

N L 5 Tariff

A, E Income tax rate **0%**

45,000 FCFA	For the initial payment which may be regarded as 'User's Contribution'	up to 2006 up to 2011 after 2012	Tariff setting after 10 years
<b>5,800</b> FCFA/Unit/month	For the monthly payment:	0% 1% 1.0%	Increase in tariff after 10 years
741,000 (Total amount of user's payment for 10 years)	5,924 Minimum Accu. Cashflow	5,800 5,858 5,858	

OK 6 No. of Subscribers

<b>300</b> Units	5,924 Minimum Accu. Cashflow	4,787 Minimum Acc. Cashflow	after reduction of the replacement cost	139.8
	5,924 Cash Position after 10 year	4,787 Cash Position after 20 year	where the amount required for replacement be secured, say, <b>135.0</b> Million CFA.	
	-43,980 For equity liquidation		18,177 to secure the cash position on the plus side over a period of 20 years	

7 Depreciation (US\$ = 650 FCFA)

	FCFA/System	Life	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
PV Module (Wp)	55	180,000	20	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Charge controller (A)	8	40,000	10	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Battery (Ah)	100	83,000	4	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750	20,750
Lamps	4	52,000	5	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400	10,400
Pole, Cable, etc.	1	60,000	20	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Installation, Transport	1	35,000	20	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
Sub-total		450,000		48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900
Difference		0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		450,000		48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900	48,900
Depreciation				14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670

Chart 4.11 (2) Financial Business Model for PV Rural Electrification

I, L		8 Projection of Income																	
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
Fee Collection Rate			100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Revenue		20,880	20,880	20,880	20,880	20,880	20,880	21,089	21,089	21,089	21,089	21,089	21,089	21,089	21,089	21,089	21,089	21,089	21,089
Expenses Direct cost		5,112	5,112	5,112	5,112	3,600	3,600	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024
<b>Gross Profit</b>		0	15,768	15,768	15,768	17,280	17,280	18,065	18,065	18,065	18,065	18,065	18,065	18,065	18,065	18,065	18,065	18,065	18,065
Depreciation			14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
Interest		0	1,890	1,890	1,890	1,890	1,890	1,890	1,512	1,134	756	378	0	0	0	0	0	0	0
<b>Net Profit</b>		0	-792	-792	-792	720	720	1,505	1,823	2,261	2,639	3,017	3,395	3,395	3,395	3,395	3,395	3,395	3,395
Income tax		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum income tax		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Income		0	-792	-792	-792	720	720	1,505	1,823	2,261	2,639	3,017	3,395	3,395	3,395	3,395	3,395	3,395	3,395
Accumulated Profit		0	-792	-1,584	-2,376	-1,656	-936	569	2,452	4,712	7,351	-6,612	-3,217	177	3,572	6,967	10,362	13,757	27,336
J		Debt Financing																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20
Loan at beg			27,000	27,000	27,000	27,000	27,000	27,000	21,600	16,200	10,800	5,400	0	0	0	0	0	0	0
Repayment								5,400	5,400	5,400	5,400	5,400							
Interest		0	1,890	1,890	1,890	1,890	1,890	1,890	1,512	1,134	756	378	0	0	0	0	0	0	0
Loan at end		27,000	27,000	27,000	27,000	27,000	27,000	21,600	16,200	10,800	5,400	0							
H		Cash-Flow Stream																	
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
Net income		0	-792	-792	-792	720	720	1,505	1,823	2,261	2,639	3,017	3,395	3,395	3,395	3,395	3,395	3,395	3,395
Depreciation		0	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
User's contribution		13,500																	
Equity		27,000										-27,000							
Additional equity (Work)		0										-16,980			0				
Loan		27,000																	
Subsidy		67,500																	
Repayment		0	0	0	0	0	0	5,400	5,400	5,400	5,400	5,400	0	0	0	0	0	0	0
Initial Investment		135,000										100%							
Replacement		0	0	0	0	24,900	15,600	0	0	24,900	0	27,600	0	24,900	0	0	15,600	24,900	135,000
C		PV Module (Wp)																	
		186,000																	54,000
Charge controller (A)		40,000										12,000							12,000
Battery (Ah)		83,000				24,900				24,900				24,900				24,900	24,900
Lamps		52,000					15,600				15,600					15,600			15,600
Pole, Cable, etc.		60,000																	18,000
Installation, Transport		35,000																	10,500
Profit for Supplier		0																	

Chart 4.11 (3) Financial Business Model for PV Rural Electrification

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
H	Net Cashflow	0	13,878	13,878	13,878	-9,510	-210	10,775	11,153	-13,369	11,909	-59,293	18,065	-6,835	18,065	18,065	2,465	-6,835	-116,935	
	Accu. Cashflow	0	13,878	27,756	41,634	32,124	31,914	42,689	53,842	40,472	52,381	-6,912	11,153	4,317	22,382	40,447	42,912	36,077	-26,664	
	Deposit bank rate	4.25%	13,878	28,228	43,066	35,020	36,001	47,999	60,784	49,482	63,073	5,924	24,190	18,177	36,860	56,178	60,553	55,777	4,787	
	% of the outstanding amount	80%																		
			2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021		
		-27,000	13,878	13,878	13,878	-9,510	-210	10,775	11,153	-13,369	11,909	-59,293	18,065	-6,835	18,065	2,465	-6,835	-116,935		
	Equity Portion	-27,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
80%	Bank deposit effect for 80% of the outstandings at the beg. of the year	-27,000	0	472	960	1,464	1,191	1,224	1,632	2,007	1,682	2,144	201	322	618	1,253	1,919	2,059	4,002	
	Real Cash-Flow	-27,000	13,878	14,350	14,838	-8,046	981	11,999	12,785	-11,303	13,591	-57,149	18,266	-6,013	18,583	19,318	4,375	-4,776	-112,953	
	Operator's ROE =		13,878	28,228	43,066	35,020	36,001	47,999	60,784	49,482	63,073	5,924	24,190	18,177	36,860	56,178	60,553	55,777	4,787	
O	Profitability	5.0%	-27,000																	
	Profit at sale	15,000																		
	Operator ROE =	13.9%	-12,000	0	0	0	0	0	0	0	0	43,983								
	(for 10 years)																			
	Equity owner	17.7%	-40,500	13,878	14,350	14,838	-8,046	981	11,999	12,785	-11,303	13,591	-13,169	19,762	-4,467	20,282	20,971	6,084	-3,009	-110,912
	(for 20 years)																			
	Accu. Cashflow		13,878	28,228	43,066	35,020	36,001	47,999	60,784	49,482	63,073	49,904	69,666	65,199	85,481	106,452	112,536	109,527	66,228	
	Profitability																			
	Liquidation of the operator's equity =												-43,980							
	Cash outstandings after the liquidation =												5,924	-16,980						
H, I	Balance Sheets	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
	Loan	27,000	27,000	27,000	27,000	27,000	27,000	21,600	16,200	10,800	5,400	0	0	0	0	0	0	0	0	
	User's contribution	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	
	Additional equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Equity	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	0	0	0	0	0	0	0	0	
	Retained earnings	0	-792	-1,112	-844	1,240	3,151	5,879	9,394	13,725	18,043	6,224	9,820	14,037	18,050	22,698	28,003	33,457	58,787	
	Subsidy	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	67,500	
	Liabilities & Equity	135,000	134,208	133,888	134,656	136,240	138,151	135,479	133,594	132,522	131,443	87,224	90,820	95,037	99,050	103,698	109,003	114,457	139,787	
	Cash	0	13,878	28,228	43,066	35,020	36,001	47,999	60,784	49,482	63,073	5,924	24,190	18,177	36,860	56,178	60,553	55,777	4,787	
	Assets	135,000	120,330	105,660	90,990	101,220	102,150	87,480	72,810	83,040	68,370	81,300	66,630	76,860	62,190	47,520	48,450	58,680	135,000	
	Assets	135,000	134,208	133,888	134,656	136,240	138,151	135,479	133,594	132,522	131,443	87,224	90,820	95,037	99,050	103,698	109,003	114,457	139,787	
													0	0	0	0	0	0	0	

Chart 4.12 (1) Pricing Structure

Chart 3 PRICING STRUCTURE

1 Renewal of Equipment	1.1	Replacement cost of PV system components
	1.2	Reasonable life term of the various PV system components
2 Management Cost of Equipment	2.1	Class management fees (consumption and overvoltage)
	2.2	Cost for assistance on site collection
3 Maintenance Cost of Equipment	3.3	Salary of the Operator
	3.1	Salary of the local technician
	3.2	Salary of the external technician
	3.4	Possible engineer cost

Replacement Cost	1.1 & 1.2	Price (CFA)	Life	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020	2021	Total
PV Module (Wp)		180,000	20										40,000							180,000	180,000
Charge controller (A)		40,000	10																	40,000	80,000
Battery (Ah)		23,000	4				83,000				83,000				83,000					23,000	415,000
Lamps		52,000	5					52,000				52,000								52,000	260,000
Renewal (1.1 + 1.2)				0	0	0	83,000	52,000	0	0	83,000	0	92,000	0	83,000	0	0	52,000	0	355,000	853,000
No of installed system	300	Total	(x1,000 CFA)	0	0	0	24,900	15,600	0	0	24,900	0	27,600	0	24,900	0	0	15,600	0	106,500	264,900

Monthly Expenses for (C) & (M)				Installation Units = 300																							
Plus Plus	100	300	500	1 to 3 years	3 to 5 years	3 to 10 years	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Local Technician	1.0	3.0	5.0	3.0	2.0	2.0																					
External Technician	1.0	2.0	2.5	2.0	1.5	1.0																					
X 2.1	Local Technician	40,000	CFA/month	1,400	1,440	1,480	1,520	1,560	1,600	1,640	1,680	1,720	1,760	1,800	1,840	1,880	1,920	1,960	2,000	2,040	2,080	2,120	2,160	2,200	2,240	2,280	2,320
Y 3.2	External Technician	30,000	CFA/month	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,140	1,160	1,180	1,200	1,220	1,240	1,260	1,280	1,300	1,320	1,340	1,360	1,380	1,400	1,420	1,440	
Z 3.3	Transportation	25,000	CFA/month	833	850	867	883	900	917	933	950	967	983	1,000	1,017	1,033	1,050	1,067	1,083	1,100	1,117	1,133	1,150	1,167	1,183	1,200	
20% of (X+Y+Z)	Miscellaneous	25,000	CFA/month	833	852	872	890	908	926	944	962	980	998	1,016	1,034	1,052	1,070	1,088	1,106	1,124	1,142	1,160	1,178	1,196	1,214	1,232	
Total (CFA/month)				426	436	446	456	466	476	486	496	506	516	526	536	546	556	566	576	586	596	606	616	626	636	646	
Total Investment Cost (1,000 CFA)		133,000	1,000 CFA/year	3,112	3,112	3,112	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	3,660	
% of the total investment cost				3.8%	3.8%	3.8%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%	
Community Empowerment Cost				1,400	1,400	1,400	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	
15% of Users' Contribution				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Local Technician	0	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440
External Technician	0	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920	1,920
Transportation	0	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
Miscellaneous	0	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852	852

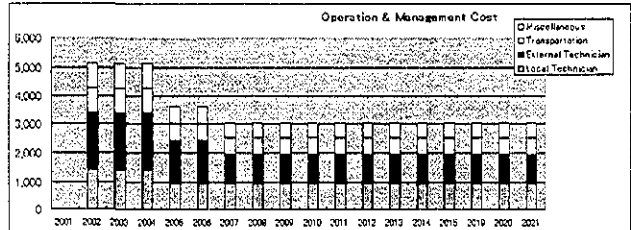


Chart 4.12 (2) Pricing Structure

Monthly Expenses for O & M			Installation Units = 300																		
			This Plan	1 to 3 years	3 to 5 years	5 to 10 years															
			Local Technician	3.0	2.0	2.0															
			External Technician	2.0	1.5	1.0															
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020	2021
X	3.1	Local Technician	40,000 CFA/month	1,440	1,440	1,440	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
Y	3.2	External Technician	80,000 CFA/month	1,920	1,920	1,920	1,440	1,440	960	960	960	960	960	960	960	960	960	960	960	960	960
Z	2.2	Transportation	25,000 CFA/month	900	900	900	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
20% of (X+Y+Z) equal to (2.3 + 3.3 + Miscellaneous)			29,000 CFA/month	852	852	852	600	600	504	504	504	504	504	504	504	504	504	504	504	504	
% could be determined at the discretion of the operator.			Total (CFA/month)	426	426	426	300	300	252	252	252	252	252	252	252	252	252	252	252	252	
Initial Investment Cost (1,000 CFA)			1,000 CFA/year	5,112	5,112	5,112	3,600	3,600	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	
135,000			% of the initial investment cost	3.8%	3.8%	3.8%	2.7%	2.7%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%	
			Cost/system/month (CFA)	1,420	1,420	1,420	1,000	1,000	840	840	840	840	840	840	840	840	840	840	840	840	

Monthly Expenses for O & M			Installation Units = 500																		
			This Plan	1 to 3 years	3 to 5 years	5 to 10 years															
			Local Technician	5.0	3.0	3.0															
			External Technician	2.5	2.0	1.5															
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020	2021
X	3.1	Local Technician	40,000 CFA/month	2,400	2,400	2,400	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	
Y	3.2	External Technician	80,000 CFA/month	2,400	2,400	2,400	1,920	1,920	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	1,440	
Z	2.2	Transportation	25,000 CFA/month	1,500	1,500	1,500	900	900	900	900	900	900	900	900	900	900	900	900	900	900	
20% of (X+Y+Z) equal to (2.3 + 3.3 + Miscellaneous)			29,000 CFA/month	1,260	1,260	1,260	852	852	756	756	756	756	756	756	756	756	756	756	756	756	
% could be determined at the discretion of the operator.			Total (CFA/month)	630	630	630	426	426	378	378	378	378	378	378	378	378	378	378	378	378	
Initial Investment Cost (1,000 CFA)			1,000 CFA/year	7,560	7,560	7,560	5,112	5,112	4,536	4,536	4,536	4,536	4,536	4,536	4,536	4,536	4,536	4,536	4,536		
225,000			% of the initial investment cost	3.4%	3.4%	3.4%	2.3%	2.3%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%		
			Cost/system/month (CFA)	2,100	2,100	2,100	1,420	1,420	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260		

Monthly Expenses for O & M			Installation Units = 100																		
			This Plan	1 to 3 years	3 to 5 years	5 to 10 years															
			Local Technician	1.0	1.0	1.0															
			External Technician	1.0	1.0	0.5															
				2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2020	2021
X	3.1	Local Techni	40,000 CFA/month	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	
Y	3.2	External Tech	80,000 CFA/month	960	960	960	960	960	480	480	480	480	480	480	480	480	480	480	480	480	
Z	2.2	Transportation	25,000 CFA/month	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	
20% of (X+Y+Z) equal to (2.3 + 3.3 + Miscellaneous)			29,000 CFA/month	348	348	348	348	348	252	252	252	252	252	252	252	252	252	252	252		
% could be determined at the discretion of the operator.			Total (CFA/month)	174	174	174	174	174	126	126	126	126	126	126	126	126	126	126	126		
Initial Investment Cost (1,000 CFA)			1,000 CFA/year	2,088	2,088	2,088	2,088	2,088	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512	1,512		
45,000			% of the initial investment cost	4.6%	4.6%	4.6%	4.6%	4.6%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%		
			Cost/system/month (CFA)	580	580	580	580	580	420	420	420	420	420	420	420	420	420	420	420		

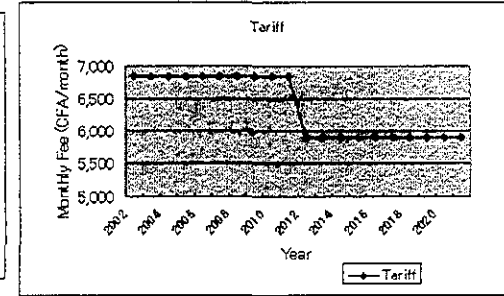
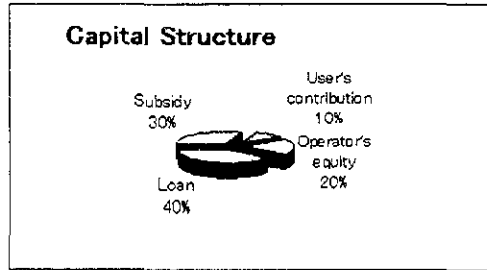


Chart 4.13 (1) Proposed Business Model: Financial Model (Subsidy 30%)

**Financial Model for PV Rural Electrification**  
 1 English, 0 French (In case of liquidation)

**Pre-Conditions**

1 System Unit Cost (55 Wp)	<b>450</b>	(1,000 FCFA)
2 O & M Cost for Private Operator	See "O & M and Renewal"	
3 Capital Structure		
Initial Investment Cost	135,000	0.21 US\$ million
User's contribution	10%	13,500
Operator's equity	20%	27,000
Loan	40%	54,000
Interest	7.0%	
Repayment	10,800 x 1,000 CFA/year	
Grace period	5 years	
Repayment period	10 years	



4 Others	<b>Subsidy 30%</b>	40,500	ROE = <b>13.9%</b> over a period of 10 years for the operator's profitability	15,000 Profit at sales
			ROE = <b>19.6%</b> over a period of 20 years for the operator's profitability without liquidation	

Depreciation method A straight-line method  
 Income tax rate **0%**

5 Tariff

45,000 FCFA For the initial payment which may be regarded as 'User's Contribution'

OK

**6,850** FCFA/Unit/month For the monthly payment

867,000 (Total amount of user's payment for 10 years)

6 No. of Subscribers

**300** Units

1,838	Minimum Accu. Cashflow
1,838	Cash Position after 10 years
-43,980	For equity liquidation

up to 2006	up to 2011	after 2012
0%	0%	-14%
6,850	6,350	5,291

Tariff setting after 10 years  
 Increase in tariff after 10 years

535	Minimum Acc. Cashflow
535	Cash Position after 20 year

after reduction of the replacement cost 135.5  
 where the amount required for replacement be secured, say, **135.0** Million CFA.  
 14,104 to secure the cash position on the plus side over a period of 20 years

7 Depreciation

(US\$ = 650 FCFA)

<b>Depreciation</b>	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
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Chart 4.13 (2) Proposed Business Model: Financial Model (Subsidy 30%)

8 Projection of Income		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
Fee Collection Rate		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Revenue		24,660	24,660	24,660	24,660	24,660	24,660	24,660	24,660	24,660	24,660	24,660	21,208	21,208	21,208	21,208	21,208	21,208	21,208
Expenses	Direct cost	5,112	5,112	5,112	3,600	3,600	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024
	<b>Gross Profit</b>	0	19,548	19,548	21,060	21,060	21,636	21,636	21,636	21,636	21,636	21,636	18,184	18,184	18,184	18,184	18,184	18,184	18,184
	Depreciation	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
	Interest	0	3,780	3,780	3,780	3,780	3,780	3,780	3,024	2,268	1,512	756	0	0	0	0	0	0	0
	<b>Net Profit</b>	0	1,098	1,098	1,098	2,610	2,610	3,186	3,942	4,698	5,454	6,210	3,514	3,514	3,514	3,514	3,514	3,514	3,514
	Income tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minimum income tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	<b>Net Income</b>	0	1,098	1,098	1,098	2,610	2,610	3,186	3,942	4,698	5,454	6,210	3,514	3,514	3,514	3,514	3,514	3,514	3,514
	<b>Accumulated Profit</b>	0	1,098	2,196	3,294	5,904	8,514	11,700	15,642	20,340	25,794	31,004	18,537	22,051	25,565	29,078	32,592	36,105	40,160

Debt Financing		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20
	Loan at beg.		54,000	54,000	54,000	54,000	54,000	54,000	43,200	32,400	21,600	10,800	0	0	0	0	0	0	0
	Repayment								10,800	10,800	10,800	10,800	10,800						
	Interest	0	3,780	3,780	3,780	3,780	3,780	3,780	3,024	2,268	1,512	756	0	0	0	0	0	0	0
	Loan at end	54,000	54,000	54,000	54,000	54,000	54,000	43,200	32,400	21,600	10,800	0							

Cash-Flow Stream		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
	Net income	0	1,098	1,098	1,098	2,610	2,610	3,186	3,942	4,698	5,454	6,210	3,514	3,514	3,514	3,514	3,514	3,514	3,514
	Depreciation	0	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
plus	User's contribution	13,500																	
plus	Equity	27,000										-27,000							
plus	Additional equity (Work)	0										-16,980			0				
plus	Loan	54,000																	
plus	Subsidy	40,500																	
minus	Repayment	0	0	0	0	0	0	10,800	10,800	10,800	10,800	10,800	0	0	0	0	0	0	0
minus	Initial investment	135,000																	
minus	<b>Replacement</b>		0	0	0	24,900	15,600	0	0	24,900	0	2,700	0	24,900	0	0	15,600	24,900	135,000



**Chart 4.13 (4) Proposed Business Model: Financial Model (Subsidy 30%)**

Cashflow Stream & Cash Position (In case of liquidation)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
Cashflow	15,768	16,304	16,858	-5,956	3,141	8,624	9,673	-14,142	11,033	-59,416	18,248	-6,032	18,663	19,298	4,354	-4,798	-112,958
Cumu. Cashflow	15,768	32,072	48,931	42,974	46,115	54,739	64,412	50,270	61,304	1,888	20,136	14,104	32,767	52,065	56,418	51,620	535

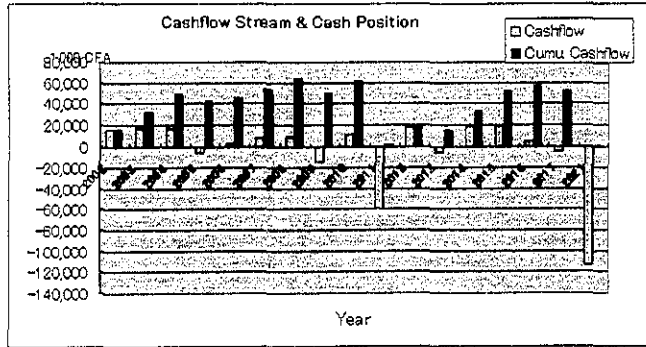


Chart 4.14 (1) Proposed Business Model: Financial Model (Subsidy 45%)

1 **Financial Model for PV Rural Electrification**  
 1 English, 0 French (in case of liquidation)

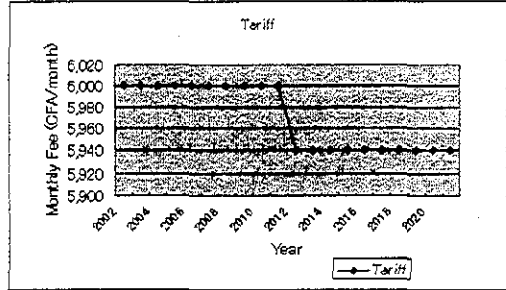
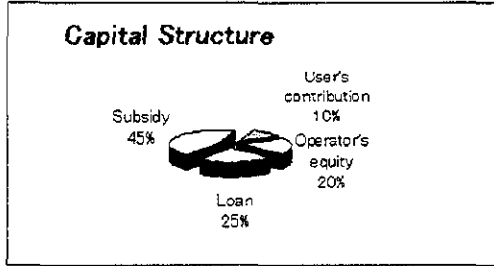
Pre-Conditions

1 System Unit Cost (\$S Wp)  (1,000 FCFA)

2 O & M Cost for Private Operator See "O & M and Renewal"

3 Capital Structure

Initial Investment Cost	135,000	0.21	US\$ million
User's contribution	10%	13,500	
Operator's equity	20%	27,000	
Loan	25%	33,750	
Interest	7.0%		
Repayment	6,750	x 1,000 CFA/year	
Grace period	5	years	
Repayment period	10	years	



Subsidy 45% 60,750 ROE =  $\frac{94,500}{15,000} = 13.0\%$  Amount (= Subsidy + Loan) over a period of 10 years for the operator's profitability Profit at sales  
 ROE =  $\frac{17.1\%}{17.1\%}$  over a period of 20 years for the operator's profitability without liquidation

4 Others

Depreciation method A straight-line method  
 Income tax rate

5 Tariff

45,000 FCFA For the initial payment which may be regarded as 'User's Contribution'

FCFA/Unit/month For the monthly payment

up to 2006	up to 2011	after 2012
0%	0%	-1%
6,000	6,000	5,940

Tariff setting after 10 years  
 Increase in tariff after 10 years

OK

765,000 (Total amount of user's payment for 10 years) 1,44\$ Minimum Accu. Cashflow

Units 1,44\$ Cash Position after 10 years

Units -43,980 For equity liquidation

1,933 Minimum Acc. Cashflow  
 1,933 Cash Position after 20 year after reduction of the replacement cost 137.0  
 where the amount required for replacement be secured, say,  Million CFA.  
 13,994 to secure the cash position on the plus side over a period of 20 years

7 Depreciation	(US\$ = 650 FCFA)																		
Denreciation		14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670

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Chart 4.14 (2) Proposed Business Model: Financial Model (Subsidy 45%)

8 Projection of Income		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
	Fee Collection Rate		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Revenue	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,600	21,384	21,384	21,384	21,384	21,384	21,384	21,384
	Expenses Direct cost	5,112	5,112	5,112	5,112	3,600	3,600	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024
	<b>Gross Profit</b>	0	16,488	16,488	16,488	18,000	18,000	18,576	18,576	18,576	18,576	18,576	18,360	18,360	18,360	18,360	18,360	18,360	18,360
	Depreciation	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
	Interest	0	2,363	2,363	2,363	2,363	2,363	2,363	1,890	1,418	945	473	0	0	0	0	0	0	0
	<b>Net Profit</b>	0	-545	-545	-545	968	968	1,544	2,016	2,489	2,961	3,434	3,690	3,690	3,690	3,690	3,690	3,690	3,690
	Income tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minimum income tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Net Income	0	-545	-545	-545	968	968	1,544	2,016	2,489	2,961	3,434	3,690	3,690	3,690	3,690	3,690	3,690	3,690
	Accumulated Profit	0	-545	-1,089	-1,634	-666	302	1,845	3,861	6,350	9,311	-4,236	-546	3,144	6,834	10,524	14,214	17,904	32,664
<b>Debt Financing</b>		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20
	Loan at beg.		33,750	33,750	33,750	33,750	33,750	33,750	27,000	20,250	13,500	6,750	0	0	0	0	0	0	0
	Repayment							6,750	6,750	6,750	6,750	6,750							
	Interest	0	2,363	2,363	2,363	2,363	2,363	2,363	1,890	1,418	945	473	0	0	0	0	0	0	0
	Loan at end	33,750	33,750	33,750	33,750	33,750	33,750	27,000	20,250	13,500	6,750	0							
<b>Cash-Flow Stream</b>		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
	Net income	0	-545	-545	-545	968	968	1,544	2,016	2,489	2,961	3,434	3,690	3,690	3,690	3,690	3,690	3,690	3,690
	Depreciation	0	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
plus	User's contribution	13,500																	
plus	Equity	27,000										-27,000							
plus	Additional equity (Work)	0										-16,980			0				
plus	Loan	33,750																	
plus	Subsidy	60,750																	
minus	Repayment	0	0	0	0	0	0	6,750	6,750	6,750	6,750	6,750	0	0	0	0	0	0	0
minus	Initial Investment	135,000										100%							
minus	Replacement		0	0	0	24,900	13,600	0	0	24,900	0	27,600	0	24,900	0	0	15,600	24,900	135,000

Chart 4.14 (3) Proposed Business Model: Financial Model (Subsidy 45%)

Net Cashflow		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
		0	14,126	14,126	14,126	-9,263	38	9,464	9,936	-14,492	10,881	-60,227	18,360	-6,540	18,360	18,360	2,760	-6,540	-116,640	
	Accu. Cashflow	0	14,126	28,251	42,377	33,114	33,152	42,615	52,551	38,060	48,941	-11,286	7,074	534	18,894	37,254	40,014	33,474	-28,086	
	Deposit bank rate	4.25%																		
			14,126	28,731	43,834	36,061	37,325	48,058	59,628	47,163	59,648	1,449	19,859	13,994	32,830	52,306	56,844	52,237	1,983	
	% of the outstanding amount	80%																		
			2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021		
		-27,000	14,126	14,126	14,126	-9,263	38	9,464	9,936	-14,492	10,881	-60,227	18,360	-6,540	18,360	18,360	2,760	-6,540	-116,640	
	Equity Portion	-27,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
80%	Bank deposit effect for 80% of the outstandings	0	430	977	1,490	1,226	1,269	1,624	2,027	1,604	2,028	49	675	476	1,116	1,778	1,933	3,901		
at the beg. of the year	Real Cash-Flow	-27,000	14,126	14,606	15,102	-7,772	1,264	10,733	11,570	-12,464	12,483	-58,199	18,409	-5,865	18,836	19,476	4,538	-4,607	-112,739	
	59%		14,126	28,731	43,834	36,061	37,325	48,058	59,628	47,163	59,648	1,449	19,859	13,994	32,830	52,306	56,844	52,237	1,983	
Profitability		5.0%	-27,000																	
	Profit at sale	15,000																		
Operator	ROE =	13.9%	-12,000	0	0	0	0	0	0	0	0	43,980								
(for 10 years)																				
Equity owner		17.1%	-40,500	14,126	14,606	15,102	-7,772	1,264	10,733	11,570	-12,464	12,483	-14,218	19,905	-4,319	20,435	21,129	6,248	-2,840	-110,719
(for 20 years)	Cumulative Cashflow		14,126	28,731	43,834	36,061	37,325	48,058	59,628	47,163	59,648	45,429	65,334	61,015	81,450	102,579	108,827	105,987	63,424	
Balance Sheets																				
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
	Loan	33,750	33,750	33,750	33,750	33,750	33,750	27,000	20,250	13,500	6,750	0	0	0	0	0	0	0	0	
	User's contribution	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	
	Additional equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Equity	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	0	0	0	0	0	0	0	0	
	Retained earnings	0	-545	-609	-176	2,281	4,405	7,288	10,938	15,453	20,018	8,409	12,239	16,604	20,770	25,576	31,044	36,667	62,753	
	Subsidy	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	60,750	
	Liabilities & Equity	135,000	134,456	134,391	134,824	137,281	139,475	135,538	132,438	130,203	128,018	82,749	86,489	90,854	95,020	99,826	105,294	110,917	136,983	
	Cash	0	14,126	28,731	43,834	36,061	37,325	48,058	59,628	47,163	59,648	1,449	19,859	13,994	32,830	52,306	56,844	52,237	1,983	
	Assets	135,000	120,330	105,660	90,990	101,220	102,150	87,480	72,810	83,040	68,370	81,300	66,630	76,860	62,190	47,520	48,450	58,680	135,000	
	Assets	135,000	134,456	134,391	134,824	137,281	139,475	135,538	132,438	130,203	128,018	82,749	86,489	90,854	95,020	99,826	105,294	110,917	136,983	

Chart 4.14 (4) Proposed Business Model: Financial Model (Subsidy 45%)

Cashflow Stream & Cash Position (In case of liquidation)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
Cashflow	14,126	14,606	15,102	-7,772	1,264	10,733	11,570	-12,464	12,485	-58,199	18,409	-5,865	18,836	19,476	4,538	-4,607	-112,739
Cumu. Cashflow	14,126	28,731	43,834	36,061	37,325	48,058	59,628	47,163	59,648	1,449	19,859	13,994	32,830	52,306	56,844	52,237	1,983

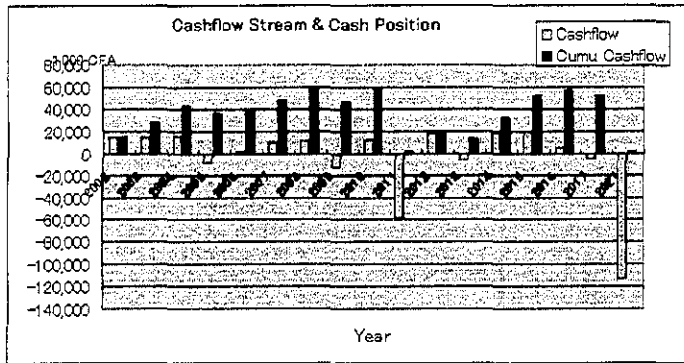




Chart 4.15 (1) Proposed Business Model: Financial Model (Subsidy 60%)

1 **Financial Model for PV Rural Electrification**

1 English, 0 French (in case of liquidation)

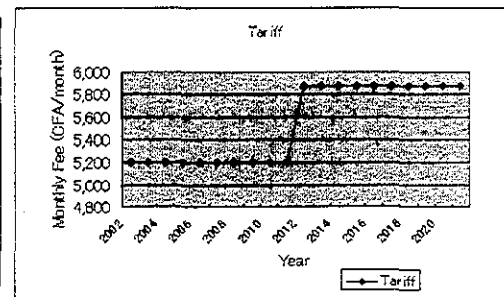
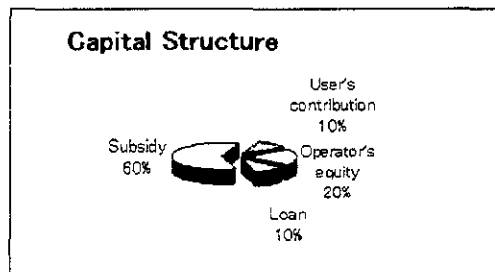
**Pre-Conditions**

1 System Unit Cost (\$\$ Wp) **450** (1,000 FCFA)

2 O & M Cost for Private Operator See "O & M and Renewal"

**3 Capital Structure**

Initial Investment Cost	135,000	0.21	US\$ million
User's contribution	10%	13,500	
Operator's equity	20%	27,000	
Loan	10%	13,500	
Interest	7.0%		
Repayment	2,700 x 1,000 CFA/year		
Grace period	5 years		
Repayment period	10 years		



4 Others **Subsidy 60%** 81,000 ROE = **13.9%** Amount (= Subsidy + Loan) 94,500 over a period of 10 years for the operator's profitability  
 ROE = **15.5%** over a period of 20 years for the operator's profitability without liquidation 15,000 Profit at sales

Depreciation method A straight-line method  
 Income tax rate **0%**

5 **Tariff**

45,000 FCFA For the initial payment which may be regarded as 'User's Contribution'  
**5,200** FCFA/Unit/month For the monthly payment

up to 2006	up to 2011	after 2012
0%	0%	13%
5,200	5,200	5,876

Tariff setting after 10 years  
 Increase in tariff after 10 years

OK

669,000 (Total amount of user's payment for 10 years)  
 6 No. of Subscribers **300** Units  
 3,113 Minimum Accu. Cashflow  
 3,113 Cash Position after 10 years  
 -43,980 For equity liquidation

1,616 Minimum Acc. Cashflow  
 1,616 Cash Position after 20 year after reduction of the replacement cost 136.6  
 ,where the amount required for replacement be secured, say, **135.0** Million CFA.  
 15,304 to secure the cash position on the plus side over a period of 20 years

7 Depreciation	(US\$ = 650 FCFA)																	
Depreciation		14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670

Chart 4.15 (2) Proposed Business Model: Financial Model (Subsidy 60%)

Projection of Income		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
	For Collection Rate		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Revenue		18,720	18,720	18,720	18,720	18,720	18,720	18,720	18,720	18,720	18,720	21,154	21,154	21,154	21,154	21,154	21,154	21,154
	Expenses Direct cost		5,112	5,112	5,112	3,600	3,600	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024	3,024
	<b>Gross Profit</b>	0	13,608	13,608	13,608	15,120	15,120	15,696	15,696	15,696	15,696	15,696	18,130	18,130	18,130	18,130	18,130	18,130	18,130
	Depreciation		14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
	Interest		945	945	945	945	945	945	756	567	378	189	0	0	0	0	0	0	0
	<b>Net Profit</b>	0	-2,007	-2,007	-2,007	-495	-495	81	270	459	648	837	3,460	3,460	3,460	3,460	3,460	3,460	3,460
	Income tax		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Minimum income tax		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	<b>Net Income</b>	0	-2,007	-2,007	-2,007	-495	-495	81	270	459	648	837	3,460	3,460	3,460	3,460	3,460	3,460	3,460
	<b>Accumulated Profit</b>	0	-2,007	-4,014	-6,021	-6,516	-7,011	-6,930	-6,660	-6,201	-5,553	-2,656	-18,237	-14,777	-11,317	-7,858	-4,398	-939	12,900

Debt Financing		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20
	Loan at beg.		13,500	13,500	13,500	13,500	13,500	13,500	10,800	8,100	5,400	2,700	0	0	0	0	0	0	0
	Repayment							2,700	2,700	2,700	2,700	2,700							
	Interest		945	945	945	945	945	945	756	567	378	185	0	0	0	0	0	0	0
	<b>Loan at end</b>	13,500	13,500	13,500	13,500	13,500	13,500	10,800	8,100	5,400	2,700	0							

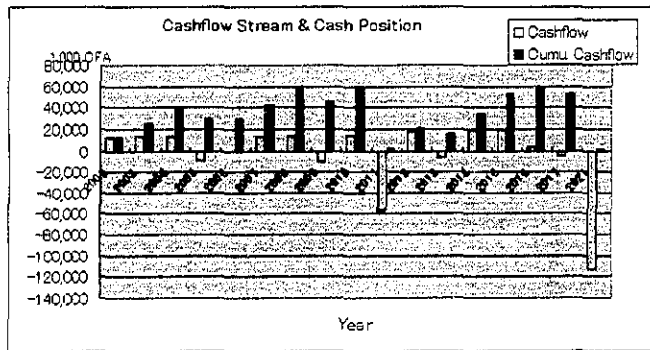
Cash-Flow Stream		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021
	Net income	0	-2,007	-2,007	-2,007	-495	-495	81	270	459	648	837	3,460	3,460	3,460	3,460	3,460	3,460	3,460
	Depreciation	0	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670	14,670
plus	User's contribution	13,500																	
plus	Equity	27,000										27,000							
plus	Additional equity (Work	0										-16,980			0				
plus	Loan	13,500																	
plus	Subsidy	81,000																	
minus	Repayment	0	0	0	0	0	0	2,700	2,700	2,700	2,700	2,700	0	0	0	0	0	0	0
minus	Initial investment	135,000										100%							
minus	<b>Replacement</b>		0	0	0	24,900	15,600	0	0	24,900	0	27,600	0	24,900	0	0	15,600	24,900	135,000

Chart 4.15 (3) Proposed Business Model: Financial Model (Subsidy 60%)

Net Cashflow		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
		0	12,663	12,663	12,663	-10,725	-1,425	12,051	12,240	-12,471	12,618	-58,773	18,130	-6,770	18,130	18,130	2,530	-6,770	-116,870	
	Accu. Cashflow	0	12,663	25,326	37,989	27,264	25,839	37,890	50,130	37,659	50,277	-8,496	9,633	2,863	20,593	39,122	41,652	34,881	-27,600	
	Deposit bank rate	4.25%	12,663	25,757	39,295	29,906	29,498	42,552	56,239	45,680	59,851	3,113	21,348	15,304	33,954	53,238	57,577	52,765	1,616	
	% of the outstanding amount	80%																		
			2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021		
	Equity Portion	-27,000	12,663	12,663	12,663	-10,725	-1,425	12,051	12,240	-12,471	12,618	-58,773	18,130	-6,770	18,130	18,130	2,530	-6,770	-116,870	
	Bank deposit effect for 80% of the outstandings	-27,000	0	431	876	1,336	1,017	1,003	1,447	1,912	1,553	2,035	106	726	520	1,154	1,810	1,958	3,896	
80%	at the beg. of the year	Real Cash-Flow	-27,000	12,663	13,094	13,539	-9,389	-408	13,054	13,687	-10,559	14,171	-56,738	18,235	-6,045	18,650	19,284	4,340	-4,813	-112,974
	7.0%		12,663	25,757	39,295	29,906	29,498	42,552	56,239	45,680	59,851	3,113	21,348	15,304	33,954	53,238	57,577	52,765	1,616	
	Profitability	5.0%	-27,000																	
	Profit at sale	15,000																		
	Operator ROE =	13.9%	-12,000	0	0	0	0	0	0	0	0	43,980								
	(for 10 years)																			
	Equity owner	15.5%	-40,500	12,663	13,094	13,539	-9,389	-408	13,054	13,687	-10,559	14,171	-12,738	19,731	-4,498	20,249	20,537	6,049	-3,045	-110,954
	(for 20 years)																			
	Cumu. Cashflow		12,663	25,757	39,295	29,906	29,498	42,552	56,239	45,680	59,851	47,093	66,824	62,525	82,574	103,511	109,560	106,515	63,058	
	Liquidation of the operator's equity =												-43,980							
	Cash outstandings after the liquidation =												3,113						-16,980	
	Operator ROE =																			
	Equity owner																			
	(for 20 years)																			
	Cumu. Cashflow																			
	Balance Sheets	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
	Loan	13,500	13,500	13,500	13,500	13,500	13,500	10,800	8,100	5,400	2,700	0	0	0	0	0	0	0	0	
	User's contribution	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	
	Additional equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Equity	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	0	0	0	0	0	0	0	
	Retained earnings	0	-2,007	-3,583	-4,715	-3,874	-3,352	-2,268	-551	1,820	4,021	-10,087	-6,522	-2,336	1,644	6,258	11,527	16,945	42,116	
	Subsidy	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000	
	Liabilities & Equity	135,000	132,993	131,417	130,285	131,126	131,648	130,032	129,049	128,720	128,221	84,413	87,978	92,164	96,144	100,758	106,027	111,445	136,616	
	Cash	0	12,663	25,757	39,295	29,906	29,498	42,552	56,239	45,680	59,851	3,113	21,348	15,304	33,954	53,238	57,577	52,765	1,616	
	Assets	135,000	120,330	105,660	90,990	101,220	102,150	87,480	72,810	83,040	68,370	81,300	66,630	76,860	62,190	47,520	48,450	58,680	135,000	
	Assets	135,000	132,993	131,417	130,285	131,126	131,648	130,032	129,049	128,720	128,221	84,413	87,978	92,164	96,144	100,758	106,027	111,445	136,616	

Chart 4.15 (4) Proposed Business Model: Financial Model (Subsidy 60%)

Cashflow Stream & Cash Position (in case of liquidation)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2021	
Cashflow	12,663	13,094	13,539	-9,389	-408	13,054	13,687	-10,559	14,171	-56,738	18,235	-6,045	18,650	19,284	4,340	-4,813	-112,974	
Cumu. Cashflow	12,663	25,757	39,295	29,906	29,498	42,552	56,239	45,680	59,851	3,113	21,348	15,304	33,954	53,238	57,577	52,765	1,616	



**Chart 4.16 Major Subjects for Business Model**

	Financial Model		Procedure Manual	Remarks
Concession				
Concession period	20 years		20 to 30 years	
Definition			Remains to be seen	
Agreement				Between ASER and Operator
Installation Units	300 Units		PLE	
Subsidy				
Rate	50 % of initial investment		30 to 50 %	Capital Structure (K)
Timing	At the time of warehouse inspection		Not clear	
Provision of loan	20 % of initial investment		20 to 40 %	Capital Structure (K)
Loan condition	Repayment: 10 years Grace: 5 years Interest: 7 %		Remains to be discussed	
Tax incentives				
Import duties			Remains to be discussed	
VAT	Provisionally exempted		Remains to be discussed	No VAT imposed on Fee for Service in JICA Pilot Project
Income tax	Tax exemption		Remains to be discussed	
Tariff				
Range	5,000 to 6,500 CFA/month		Remains to be discussed	
Payment method				
Unit Cost	450,000 CFA/system		Market value	
Renewal Cost				The model is designed to adjust itself to the change in price of renewal component
Price	The same as the initial cost		Remains to be discussed	Price trend of renewal component
Period	Ex. Battery : 4 years		Remains to be discussed	Dependency on performance of O & M
Fund Management				
Bank deposit	Deposit rate: 4.25%		Not mentioned	
Bank A/C	Daily O & M: 20% Renewal deposit: 80%		Not mentioned	Normal A/C Escrow A/C
Financial Statements	I/S, B/S, Cashflow Statements		Not mentioned	These statements be reported to ASER
Profitability			Not mentioned	
ROE	15 % around for 10 years operation		Not clearly mentioned	ROE: Return on Equity
Amount of profits	5 % on equity after 10 years on fukuri		Not mentioned	Under the assumption that 50,000 CFA/Unit has been already secured as profit on sale

## **ANNEX A RELIABLE RELATIONSHIP VITAL TO THE PUBLIC-PRIVATE INITIATIVE SCHEME**

**Subject:** How to create the reliable relationship among the parties concerned such as the executing agency (ASER), the private project operator/supplier, and village community/population.

As shown on Chart A4-2 (1), a rural community consisting of villages, exists in an administrative term, but has disadvantages in comparison with the urban community in several aspects such as availability of information, job opportunity, access to financial institution, etc. The rural community is composed principally of villagers, NGOs, PV experts, the latter two of which are assumed to have, more or less, some activities in the rural community, in part, playing some role for making up for such disadvantages. The extent of the activities varies with the location and the population of the village. Under the current circumstances, only the villagers with high annual income are affordable to pay for the system by cash or by loan. However, from the viewpoint of global diffusion of SHS system initiated by ASER, it will be very difficult to apply such models as "consumer financing" and "cash sales", mainly due to low affordability of villagers as a whole, because the initial investment cost is still high. This is the critical barrier to be overcome for the promotion of the SHS diffusion. In order to solve this problem, first of all, the other two models such as "fee-for services" and "leasing", have been so far tried and applied in the developing countries from among several models available.

Here in Senegal, the two models may be also applied in due consideration of annual income of the rural population, but the model of "leasing" is so early as to be adopted at this stage, because the financing system for leasing is not common and not matured even in the urban area. There doesn't exist leasing company which could take a risk of non-repayment for the individual village population or (the entity) of NGOs. In this connection, the mutual fund similar to the commercial bank, which has had financing operations in the rural community, should be strengthened from several aspects. The mutual fund should play a role, of both functions such as lending and saving. That is, to make savings attractive to the villagers who keep the cash in their own house, because of security and regional economic growth.

As shown as Chart A4-1, due to economy of scale and circulation of the money expected in the region, the mutual funds should make all the efforts to make villagers understand

that the money deposited in the bank from the village population will be available for lending to the village population themselves. In order to facilitate this mechanism, the mutual fund has to try to create the environment where mutual understanding and reliable relationship between them, being not sufficiently established at this moment, could be secured. If the money kept by villagers is circulated properly within the region through the banking system, more villagers are able to be more affordable for the initial payment.

At this end, villagers, NGOs, PV experts and the mutual fund co-exist in the rural community in which the major role is expected to be played by respected/reliable individual NGOs or PV experts. Finally, those reliable persons are potential locally-based entrepreneurs, as shown on Chart A4-2 (2). They will continue to play more important role in the diffusion of SHS system as a "coordinator" between the village population and the "Project Operator" or "Entrepreneur of Rural Development (Global entrepreneur)".

They continue to have close and intimate contact with village population, the role of which could not be replaced by "Entrepreneur of Rural Development". On the other hand, the major role of "Entrepreneur of Rural Development" is to train and educate those reliable NGOs, PV experts to become potential locally-based entrepreneur. In order to accomplish this objective, "Management" capability (Rural Community Empowerment) should be built in the mind of those people.

At the same times, the banking system should be also familiarized with villagers. Through experimenting this process, the reliable relationship will be created among the parties concerned, particularly between future potential locally-based entrepreneur and village population, as shown on Chart A4-2 (2).

It should be noted that such reliable relationship could not be constructed, in a hasty manner. These tasks will be taken care of by persons with passion and patience. At the same times, the representative of the villagers should be cooperative with these persons and persuasive to the villagers.

*From the outset, that is, the socio-economic study and financial study should be tried to be made for the specific project submitted by the operator to ASER for approval. During the period, the survey shall be carried out in sound collaboration with village population, in which the person in charge from the private operator be fully involved and manage the public consultations in the villagers concerned. (Chart A4-2 (1))*

After that, the major conditions for "fee-for-services" should be proposed to the village population.

This stage will be vital to the implementation of the project because reliable relationship should be constructed between the private operator and the village population. In order to create such reliable relationship, the locally-based persons such as PV experts, NGOs, etc., are advised to play an important role of "bridging role" between the private operator and village population (Chart A4-2 (2)), that is, to avoid the communication gap inherently existing between them.

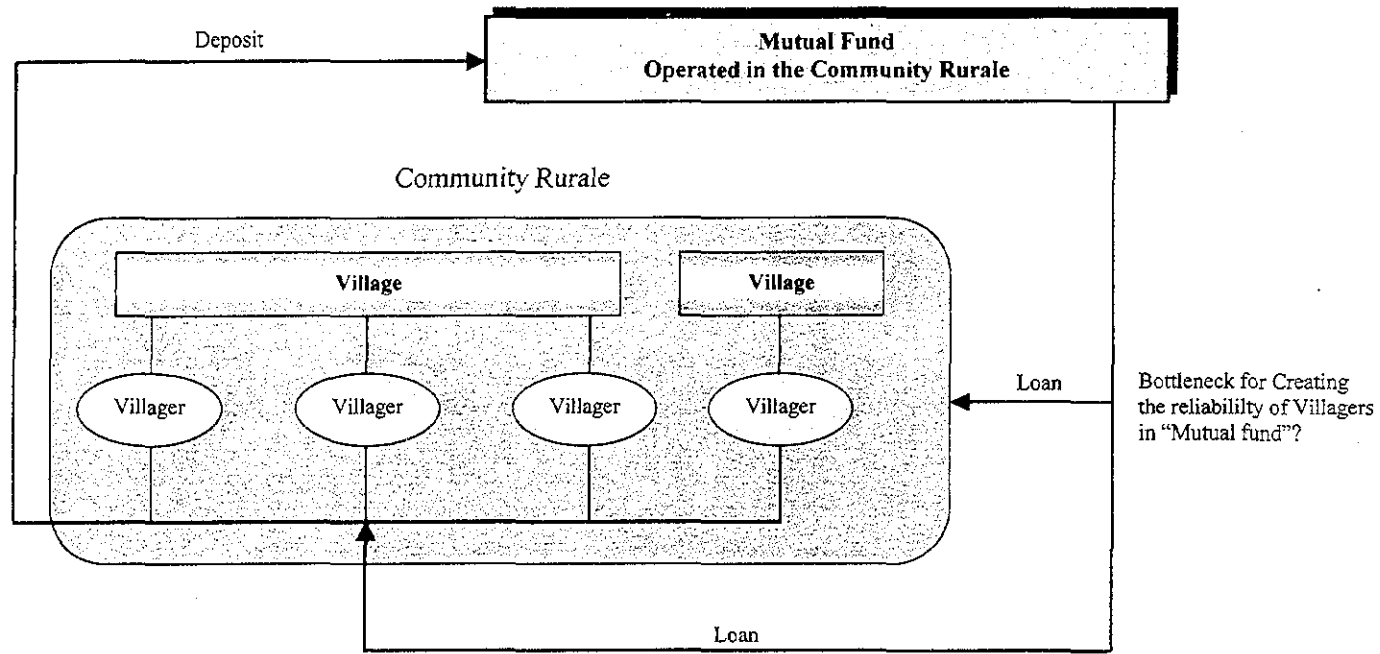
Through these processes, the electrification project will be implemented only for lighting purpose in the initial stage. However, the electrification rate, being so low at the outset, is expected to increase when other villagers appreciate the service quality of the electricity and wish to install the equipment. Creation of such environment will depend on the management capability of the private operator. Eventually there will be another opportunity for the private operator to move on for income-generating purpose as electric pumping, finally leading to rural development in close collaboration with locally-based financial institution. (Chart A4-2 (3))

In order to materialize this scheme, that is, market-oriented rural electrification, the technical support from the government will be indispensable, but only for creating the business environment where sound competition will take place among private companies without any interference from the government, while observing the market oriented regulation.

ASER is in charge of the technical and financial support from the government and CRSE (Regulation Commission of the Energy Sector) is in charge of power energy regulation for smooth and proper implementation of private-sector initiative rural electrification.



Chart A4-1 Fund Circulation Mechanism



What is "Bottleneck" for financing to villagers?

Community Empowerment & Savings

Creating the mutual understanding between Mutual Fund and Rural Community

Chart A4-2 (1) Entrepreneur of Development Rurale (Global Entrepreneur)

**Entrepreneur of Development Rurale (Global Entrepreneur)**

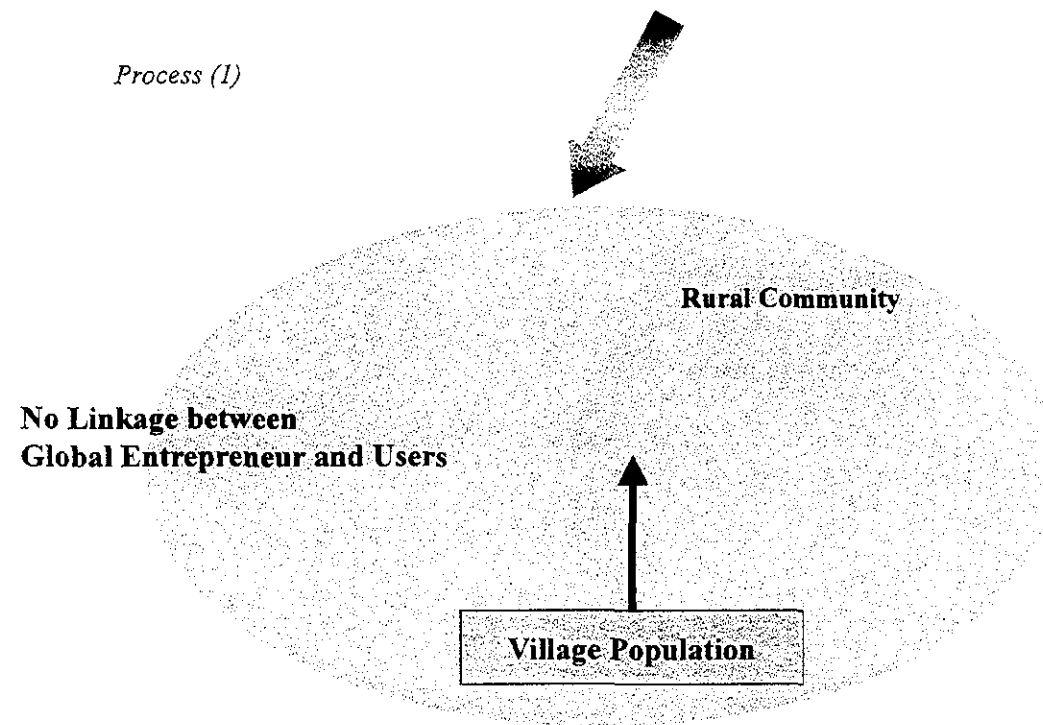
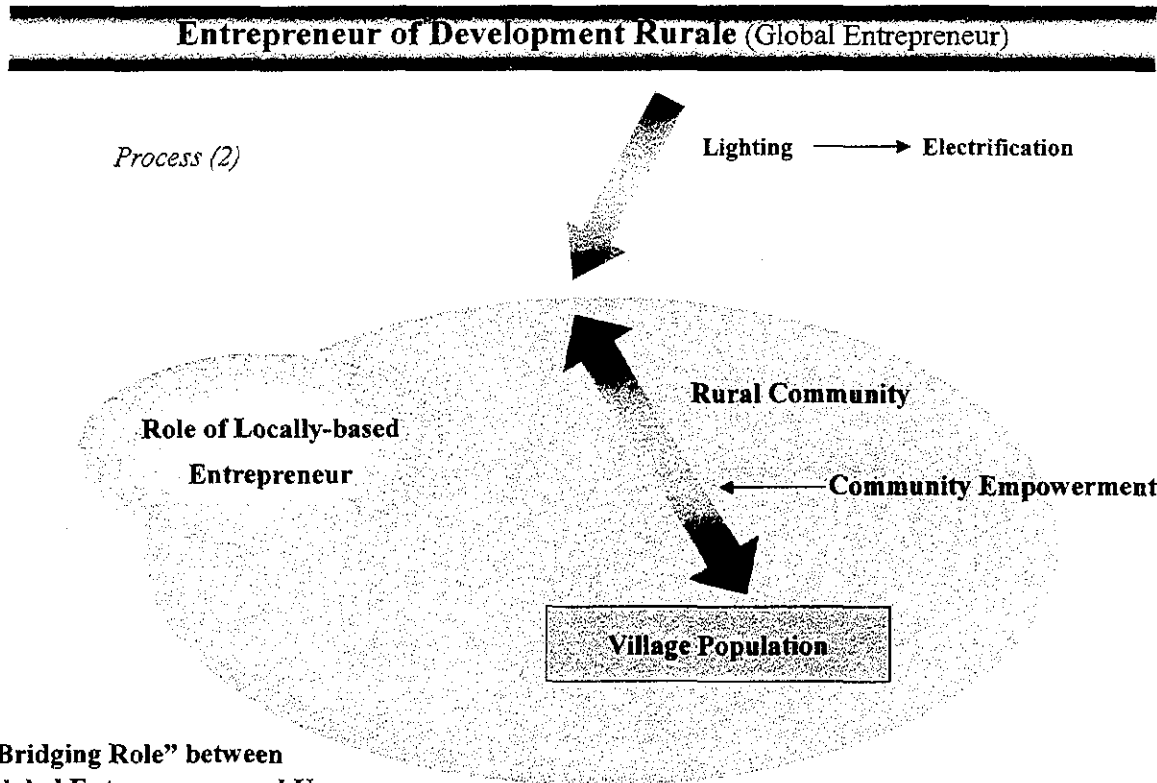
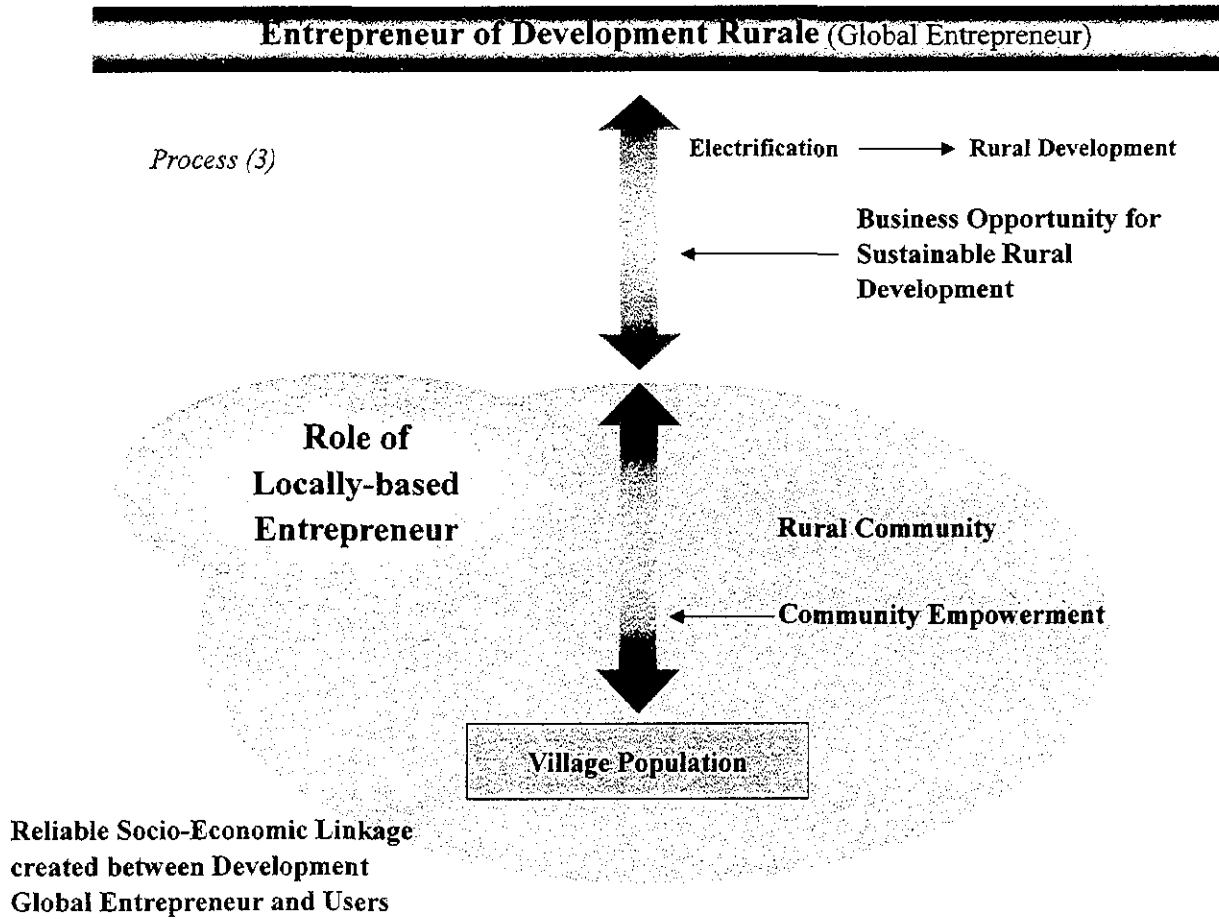


Chart A4-2 (2) Entrepreneur of Development Rurale (Global Entrepreneur)



**“Bridging Role” between  
Global Entrepreneur and Users  
For Smooth Communication**

Chart A4-2 (3) Entrepreneur of Development Rurale (Global Entrepreneur)



## ANNEX B CASH POSITION OF THE PILOT PROJECT

### Prior to the implementation of the pilot project

The regular payment of the users for the pre-condition of "Fee for Services" is computed on the following assumptions. These assumptions are to be verified in the operation stage.

- No. of system unit 150 Units
- Unit price of the system 450,000 FCFA  
(The initial cost is fully financed by JICA.)
- Initial payment of the subscriber 45,000 FCFA  
(The initial payment is equal to 10% of the above amount.)
- Estimated O & M cost
 

Manager	0.1 M/M	500,000 FCFA/month
Accountant	0.2 M/M	200,000 FCFA/month
PV Engineer	0.3 M/M	200,000 FCFA/month
Local Technician	1.0 M/M	50,000 FCFA/month
Fee collection & book keeping		
	0.2 M/M	400,000 FCFA/month
- Renewal period
 

PV Panel	20 years
Charge Controller	10 years
Battery	4 years

The regular payment has been calculated on such a condition that the number of system units to be installed be initially estimated at 150. In this calculation, renewal cost (the system price after 20 years be assumed to be gradually reduced to 50% of the current price.), and expenses for the daily operation & maintenance cost, are taken into account. Finally, 100 units of the system was purchased, 95 of which were installed at the site. The remaining 5 units are regarded as spare parts and are planned to be used in a adequate manner for the operation and maintenance purpose.

There are many elements, which will influence the sustainable management of the pilot project, such as personnel expenses, O & M expenses, etc., among which fee collection is the most significant factor. As a matter of fact, the sustainable management of the pilot project depends, to a large extent, on provision of the good services of electricity

with users, adequate fee collection and proper fund management. These matters are to be verified through the operation of the pilot project.

**Six months after the commencement of operation (as at July of 2001)**

Based on the accounting report on the performance of the past 6 months from the Pilot Project Operator, the financial analysis has been done with the assumptions as given in Table B4.z1, but major one as shown below. Through this kind of reviewing, the actions to be required are expected to be identified in order to secure the sustainability of the Pilot Project in consultation with ASER/MMEH.

Personnel Expenses

Manager	0.1 M/M	500,000 CFA/month
Accountant	0.1 M/M	200,000 CFA/month
PV Engineer	0.2 M/M	200,000 CFA/month
Local Technician	1.0 M/M	50,000 CFA/month

Administrative Expenses

25 % of the above expenses		40,000 CFA/month
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<u>Monthly Cost</u>		200,000 CFA/month
<u>Annual Cost</u>		2,400,000 CFA/year

In this analysis, the amount of the collected money is assumed to be transferred to the bank account opened exclusively for this Project with an interest rate of 5%. As a result of 20 year operation, the amount not less than 20,054,000 CFA has been calculated as cash outstanding. This amount, corresponding to almost half of the initial investment cost, will be sufficient for renewal of all PV equipment after 20 years operation.

Furthermore, to verify the impact of reduction in recurrent cost on the cash position after 20 years operation, the trial calculation has been done, resulting in the outputs of indicative figures as shown in Table B4-2. In this calculation, the annual recurrent cost has been assumed at 1.6 million CFA, 1.8 million CFA and 2 million CFA for two cases, namely, optimistic case (without default) and conservative case (with defaults of 5 households), to estimate the cash position after 20 years operation (See Table B4-3). As a result, the Pilot Project could be marginally sustainable under the following conditions;

- 1) The recurrent annual cost be controlled to less than 1.8 million CFA

- 2) The interest be secured at 4.25% (prime rate of mutual fund)
- 3) Additional cost of 5% of the initial contribution from the subscribers be secured for empowerment of "village community capacity".

**Recommendations for the future operation and management of the pilot project**

In due consideration of the formulation of PV project implementation method, the cash position of the coming 10 years operation have been forecasted, taking into account the dynamic structuring of the operation and maintenance for PV rural electrification project. Now six months have passed since the commencement of the operation. Several issues for improvement have been raised in PPMC, among which the major one was the cost borne out by the head office of the Pilot Project Operator in Dakar. Through these discussions, it has been here recommended that the recurrent cost is planned to be reviewed to secure the sustainability of the project, where the quality of services be kept at the present level and the initiative of operation and maintenance management be transferred over a period of 5 years to the Village Users Association (VUA) from the Operator in Dakar. In the monitoring stage for these periods, the possibility of reduction in recurrent cost is expected to be examined precisely, in due consideration of the management of the global rural electrification. The recurrent cost is assumed as follows;

Personnel Expenses

Local Technician	40,000 CFA/month
PV Engineer (External Technician) *1	80,000 CFA/month
Communications	20,000 CFA/month

Administrative Expenses

40% of the above expenses	56,000 CFA/month
---------------------------	------------------

Monthly Cost

196,000 CFA/month

Annual Cost

2,352,000 CFA/year

(Remarks \*1)

The monthly expenses for the external technician is proposed to be reduced over a period of 20 years as follows;

Period	Monthly cost
0 to 3	80,000 CFA/month
4 to 5	60,000 CFA/month
6 to 10	40,000 CFA/month
11 to 20	40,000 CFA/month

Here, the transfer of knowledge in PV technology, particularly maintenance method, from "External Technician" to "Local Technician" will be indispensable and at the same time the educational training to the users should be strengthened. Another "Local Technician" should be selected and trained from among the community in close collaboration and cooperation between VUA and the Pilot Project Operator. In facilitating such personnel training, it is very important for ASER to provide technical assistance in a positive manner with VUA. Through this process, if the reduction in recurrent cost be found out to be possible, it would lead to the reduction in subsidy for the initial investment. Eventually, it would strengthen the capacity building of the community, contributing to the formulation of "Community Empowerment" being vital to the sustainable community development. As shown in Table B4-4, the monitoring of the cost in comparison with the estimation, should be highly advised to be carried out in close collaboration among the village community and the Pilot Project Operator. In parallel, ASER is also advised to audit the accounting records regularly submitted by the Pilot Project Operator and to continuously monitor the performance of the Operator. This is a very persistent and steady activity, which ASER is required to follow, for the global diffusion of the rural electrification, not limited to PV electrification. Of course, it goes without saying that the quality of services should be firstly secured as it has been.



**Table B4-1 Financial Plan for Implementation of Pilot Project**

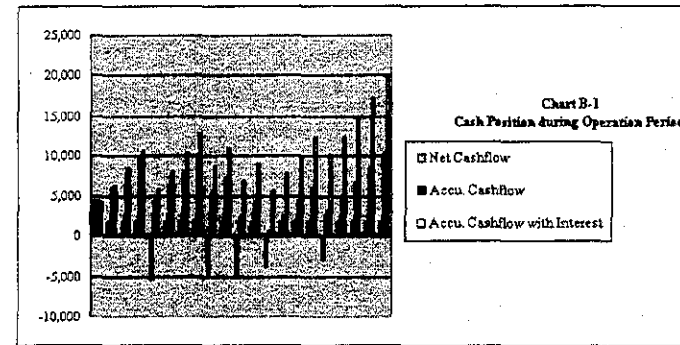
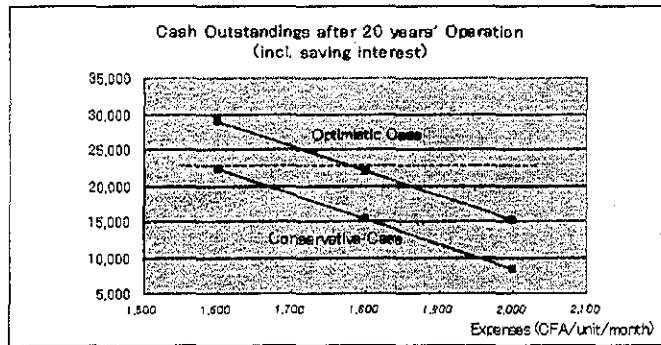
**Table 3.4-1 Financial Plan for Implementation of Pilot Project**  
(Before the implementation of the project)

Major Assumptions		(1,000 FCFA)		Monitoring items																		
1 System Unit Cost (\$5 Wp)	450	(1,000 FCFA)																				
2 Administration Cost for Private Operator (PMC)																						
	No.	FCFA/month		Standard Cost																		
Manager	0.10	500,000	for 1,500 systems	0-40																		
Accountant	0.10	200,000	for 1,500 systems	0-20																		
PV Engineer	0.20	200,000	for 1,500 systems	0-35																		
(Fee collection and book-keeping)	0.90	40,000	for 500 systems	0-00																		
Field Technician	1.00	50,000	from community village	1.00																		
Annual Expenses	2,400	25%	of the administrative cost as miscellaneous is included in the annual expenses.																			
O&M Cost = 5.3% as % of Initial Cost																						
2,105 CFA/Unit/Month 57%																						
as % of regular payments of 3,700 CFA/month																						
4 Financial Conditions																						
Initial Investment Cost	45,000	0.07 US\$ mill, inclusive of HTV																				
User's contribution	9.5%	4,275 x 1,000 CFA																				
6 Revenues																						
	45,000 FCFA	For initial subscription fee which may be regarded as "User's Contribution"																				
4300	3,700 FCFA/Unit/month	For monthly service fee																				
	10,425	Accu. cashflow after 20 years' operation, inclusive of the initial users' contribution																				
	612	Minimum accu. cashflow 4,275 30,654 In case of taking into account an interest rate of saving deposit of 5.00%																				
	22,500	The PV Price is assumed to be 50% of the current price.																				
7 No. of Subscribers																						
100	95 Units																					
8 Depreciation (US\$ = 650 FCFA)																						
FCFA/System	Life	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Depreciation		4,152	4,152	4,152	4,152	3,905	3,905	3,905	3,905	3,708	3,708	3,468	3,468	3,270	3,270	3,270	3,270	3,073	3,073	3,073	3,073	
9 Projection of Income																						
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Revenue		4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	
Expenses		2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	
Gross Profit	0	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,818	
minus Replacement		0	0	0	7,097	0	0	0	6,308	0	6,555	0	5,520	0	0	0	4,731	0	0	0	0	
Net Cashflow		4,275	1,818	1,818	1,818	-5,279	1,818	1,818	1,818	-4,490	1,818	-4,737	1,818	-3,702	1,818	1,818	1,818	-2,913	1,818	1,818	1,818	
Accu. Cashflow		4,275	6,093	7,911	9,729	4,450	6,268	8,086	9,904	5,414	7,232	2,495	4,313	612	2,430	4,248	6,066	3,153	4,971	6,789	8,607	10,425
5.00%	Accu. Cashflow with interest	4,275	6,306	8,440	10,680	5,935	8,050	10,270	12,602	8,742	10,997	6,810	8,969	5,716	7,819	10,028	12,348	10,052	12,373	14,809	17,368	20,054

**Table B4-2 Analysis of Sustainability of the Pilot Project against Expenses allocated for the Operator**

**Table 3.4-2 Analysis of Sustainability of the Pilot Project against Expenses allocated for the Operator**

Expenses CFA/unit/month	Optimistic Case			Conservative Case			Case Study	Cost Control Purpose (for optimistic case) 2,352 27,881 62.0% (B159=1, C168=1)
	1,600	1,800	2,000	1,400	1,800	2,000	Optimistic case	
Cash outstandings after 20 years' operation (incl. saving interest)	29,028	22,060	15,091	22,243	15,275	8,307	27,881	
As % of the initial investment (Initial Investment = 45,000 )	64.5%	49.0%	33.5	49.4%	33.9%	18.5%	62.0%	



**Table B4-3 Operation and Maintenance (Monitoring Stage)**

**Table 3.4-3 Operation & Maintenance (Monitoring Stage)**  
(After the Implementation of the project)

**Sustainability Analysis against Operation Cost**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Number of units installed	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
No. of subscribers	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Revenues	3,700	0	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218	4,218
Expenses Payable to Operator at Minimum	1,800	0	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052	2,052

(Cost reduction in this expenses \*) Operator at Minimum

Cl68=) \* This depends on the management of the operator and the technical support of ASER(--> education & training of External Technician).

Based on the assumption of flexible O & M estimation

	1	2,352	2,352	2,352	2,016	2,016	1,680	1,680	1,680	1,680	1,480	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
Balance of revenue and expenses	0	1,866	1,866	1,866	2,202	2,202	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Village contribution	4,275																				
Replacement Cost	0	0	0	0	7,097	0	0	0	6,308	0	6,555	0	5,520	0	0	0	4,731	0	0	0	0
5% Contingency for community improvement (5% of village contribution)		214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214	214
Accumulated Amount	4,275	5,927	7,580	9,232	4,124	6,112	8,436	10,760	6,777	9,101	4,870	7,194	3,999	6,323	8,648	10,972	8,565	10,889	13,214	15,538	17,862
17,862 Amount after 20 years																					
4.25% Accum. Amount incl. saving interest	4,275	6,109	8,021	10,014	5,331	7,546	10,191	12,948	9,515	12,244	8,533	11,220	8,502	11,187	13,987	16,906	15,218	18,189	21,286	24,515	27,881
27,881 Amount after 20 years																					

**Table B4-4 Cost Control for the Pilot Project**

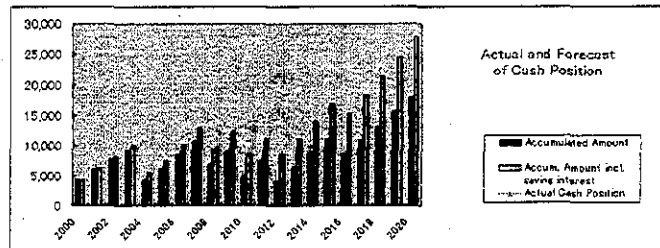
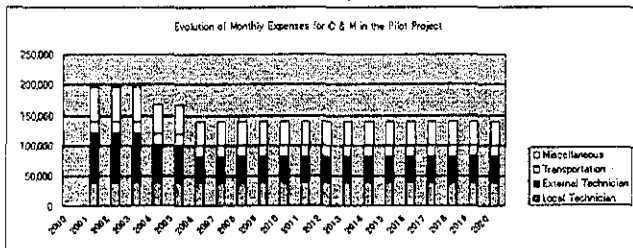
**Table 3.4-4 Cost Control for the Pilot Project**  
(For the methodology of financial analysis of the project ERIL)

**Monthly Expenses for C & M of the Pilot Project**  
(including overhead cost)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
C Local Technician		40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	
D External Technician		35,000	80,000	30,000	65,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
F Transportation		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
G Miscellaneous		35,000	36,000	36,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000
40% x (C+D+F)+G		196,000	196,000	196,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	168,000	
<b>Total (CFA/month) (Estimation)</b>		<b>196,000</b>	<b>196,000</b>	<b>196,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	<b>168,000</b>	
CFA/year (Estimation)		2,352,000	2,352,000	2,352,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	2,016,000	
CFA/year Overall		2,428,200																					
CFA/month Overall		202,350																					

**Estimation of Cash Position during Operation & Management**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Accumulated Amount	4,275	5,927	7,580	9,232	4,124	6,112	8,436	10,760	6,777	9,101	4,870	7,194	3,999	6,323	8,648	10,972	8,360	10,889	13,214	15,538	17,862
42% Accun. Amount incl. saving interest	4,275	6,109	8,021	10,014	5,321	7,346	10,191	12,948	9,215	12,244	6,533	11,220	8,502	11,187	13,987	16,906	15,218	18,189	21,286	24,515	27,881
Actual Cash Position																					



Month	2001	2002	2003	2004
	C	D	F	G
1	40,000	0	29,000	67,000
2	40,000	69,000	7,500	65,000
3	40,000	75,000	112,600	75,000
4	40,000	74,000	19,000	74,000
5	40,000	0	19,000	0
6	40,000	69,500	20,900	69,500
7				
8				
9				
10				
11				
12				
<b>Total</b>	<b>240,000</b>	<b>287,500</b>	<b>287,100</b>	<b>354,500</b>
Credit Total	1,082,100			
Annualized Cost	2,428,200			

Month	2002	2003	2004	2005
	C	D	F	G
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Credit Total	0			
Annualized Cost	0			

Month	2003	2004	2005	2006
	C	D	F	G
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Credit Total	0			
Annualized Cost	0			

Month	2004	2005	2006	2007
	C	D	F	G
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Credit Total	0			
Annualized Cost	0			

Month	2005	2006	2007	2008
	C	D	F	G
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Credit Total	0			
Annualized Cost	0			

C: Local Technician  
D: External Technician  
F: Transportation  
G: Miscellaneous