CHAPTER 2 PRESENT CONDITIONS OF RURAL ELECTRIFICATION SUB-SECTOR

2.1 Rural Electrification Sub-Sector in Transition Period

The initiation of power sector's transformation was perhaps in the mids of 1990s when the government of Senegal realized that dependence on the state-owned company (SENELEC) was no longer the appropriate policy for the farther development of power sector and rural electrification in particular. The major constraint has been the shortage of the government budget supporting expansion of electricity service provided by SENELEC. Despite of its constraint, the government financed the rural electrification (RE) sub-sector to connect 120 villages using National Energy Fund during 1994~1998.

Internal movement to liberalize power sector coincided with the global boom for privatization of infrastractural development primarily led by the World Bank. The basic strategy for the sectors transformation was traced back to "letter de politique de development de secteur de l'Energie 1996" (the energy sector policy document) in which the following three elements were clarified as the general government policy.

- disengagement of the state
- involvement of local communities
- enhancement of private initiative

The second policy followed the decentralization law (1996) addressing that local communities may award concession or leasing contract for public services to local private operators (article 317). As a part of rural infrastructure, RE facilities are possibly under the control of local communities provided that their management capacity is strengthened. The third policy does not refer to perfect privatization without the government support, but encourages private participation in operation and management of locally-based infrastructure. This primarily aims to mobilize private capital to facilitate rural infrastructural development.

In the year of 1998, the government publicized the "loi d'orientation no. 98-29" (the orientation law concerning electricity sector) where the basic structure for private-led electricity sector was legalized. The objective of the reform addressed in this law is to

guarantee electricity supply at reasonable cost and to facilitate public access to electricity service especially in rural area. The major articles addressed in this law include:

a) Operators wishing to sell electric power shall obtain a license from the Ministry of Energy. The license shall define the territory and, as the case may be, the term and obligations of public services to which the holder has agreed. (Articled 18)

b) SENELEC shall be qualified to engage in the business of bulk wholesale purchase, transmission, and the sale of electric power throughout the national territory, for a term which will be defined by a concession agreement to be signed by the Ministry of Energy. (Article 19).

c) The Ministry of Energy shall formulate and propose general policies and plans applicable to the electricity industry to the President of the Republic. The Ministry of Energy shall grant the license and concessions which shall be issued together with a license or concession agreement signed by the Minister of Energy and the holder of such license or concession. (Article 3)

d) The Regulatory Commission for the Electricity Industry shall be responsible for regulating all operations relating to generation, transmission and the sale of electricity, and pursue the objectives stated below: (Article 4)

   - to ensure financial and economic viability of electric industry and maintenance necessary to sustain its viability,
   - to protect interests of end-users with respect to pricing, supply and quality of electricity supply,
   - to enhance competition and involvement of private sector with respect to generation, transmission, distribution and the sale of electricity supply.

e) In order to decide power rate on the initial conditions and terms, the Ministry of Energy and the Regulatory Commission shall authorize the level of revenue accrued to the concession holders in connection with normal level of profitability. Such a profitability is defined as the rate of return on capital, taking into consideration the risks to which investors are subject. Profitability shall be determined in real term, taking into account inflation index set forth applicable to the concession holder. Forecast of rate base shall be based on estimates of investment expenditures, sales of assets and agreed depreciation rates. (Article 28)

f) Agence Senegalaise d'Electrification Rurale called ASER (A Senegalese Rural Electrification Administration) is to be established and responsible for providing operators with the necessary technical and financial assistance and to organiza public tenders to grant a license or concession to bidders. (Article 30)

The so-called "fee-for-service" was implicitly embodied in the concept of the orientation law of 98-29 so that any private operators eligible for conditions and terms set forth in this law shall be allowed to undertake electricity business in the territory or concessions given by the authority. The role of the stakeholders was clarified in respect of the Ministry of Energy, the Regulatory Commission and ASER.

SENELEC was subsequently privatized and a private power company of the Canadian nationality participated in corporate management of SENELEC as one of share holders. But soon or later the Canadian capital decided to stop management of SENELEC primarily because the raise of power tariff proposed by them was not approved by the concerned authority. This would render a debatable issues to the subsequent concession-holders as to competitive market price of electricity (approximately measured by consumers' willingness to pay) versus the government-regulated price. The most serious constraint will be the lack of private actors (operators) and their fear that such a long service period as 15 to 20 years would not sustain a stable profitability as expected at the initial stage. This is directly linked to the subsidy rate the authority would guarantee. But such a debatable issue as subsidy rate has remained untouched.

In the year of 1999, the Ministry of Energy prepared the "Le secteur de l'energiè au Senegal" (the energy sector document) stating the current condition of RE, the role of stakeholders such as ASER and financial intermediaries. The first draft of "Le plan d'action Senegalais d'electrification rurale, PASER" (The Plan of Action for rural Electrification in Senegal) was presented in this document. The government goal of RE targets during three consecutive stages (Preparation 1999~2000, Lauching 2001~05, and Consolidation 2006~15) were firstly clarified by the draft plan. PV was proposed as one of electrification modes, 70,000 users as planned target up to the year of 2015. After appointment of the chairman of ASER, this agency actually commenced its operation in the mid of the year 2000 (about six months after commencement of the JICA Study). Experts of the different professional fields have been mobilized as staffs of ASER and simultaneously the chairman made a preparatory work for loan agreement with the World Bank to finance the RE sub-sector. The most outstanding product prepared by ASER was

"Procedure Manual" embodying various operation procedures for PPER and ERIL, financial mechanism. Eighteen (18) concession territories are provided throughout the national land. The business modes consist of priority Rural Electrification Plan (PPER) and Rural Electrification Project (ERIL). The former is a top-down approach to RE, giving concession to an eligible operator who manages electricity service in a given territory. The latter is called a bottom-up approach to RE, giving a project-based concession to eligible local operators or village organization.

Transitional process of RE sub-sector is illustrated in Figure 2.1

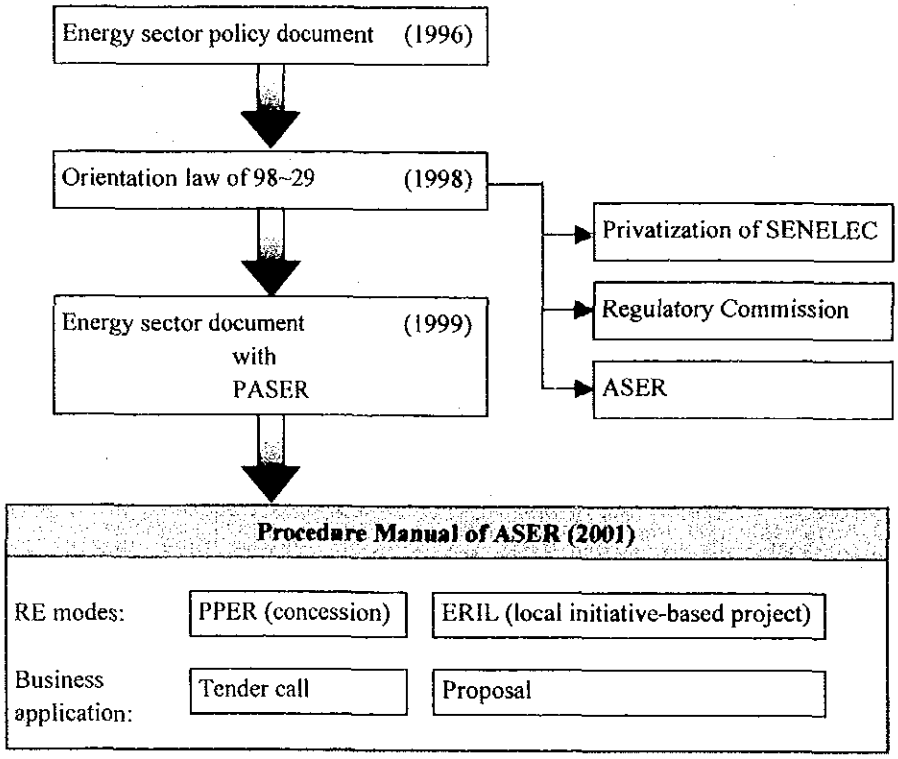


Figure 2.1 Transitional Process of RE Sub-Sector

The basic framework of operation procedures associated with two (2) RE modes was almost established thanks to the Procedure Manual. Nevertheless, there are still controversial or debatable issues which remain unsolved. The most important thing is how private entrepreneurs/investors would react to the new RE modes set forth by ASER. On March 2001, the workshop called "Validation Seminar" was held at ASER where the

concerned parties including many electrical work companies and commercial enterprises were called. The Seminar hold three (3) sessions consisting of technical, institutional and financial matters. Their reaction to the Seminar was subsequently surveyed by local consultants on behalf of KRI International Corp. The most noticeable reaction is that all participants generally acknowledge the necessity of organizations to be supported by decentralized rural operators under the responsibility of the concession-holder (PPER) or licensed operator (ERIL). Existence of rural (local) operators is also the key element for PV electrification. The other issues include interface between PPER and ERIL, subsidy rate, and intervention of SENELEC in concession area. These will be unavoidable issues to be faced by the future operators. PV electrification plan is to be carefully formulated taking into account the issues mentioned.

2.2 Likely Performance of SENELEC in RE

SENELEC that used to be the National Electricity Company but recently privatized, has been the major player of national electrification. The privatization rendered SENELEC to a profit-making organ as one of concession holders for electricity service. Under such circumstance it is unlikely that SENELEC will continue to be a driving force to facilitate rural electrification.

The current power supply of SENELEC to rural areas is marginal, heavily concentrating on urban users. As of December 1999, the number of low voltage users was reported to be 368,150 in total, of which about 12.5% or 46,000 users belong to rural area. Rural users of domestic usage (lighting, cooking, etc) turn out to be 27,961, comprising 10.8% of total domestic users (258,052) at low voltage. Electricity use of SENELEC consumers at low voltage is featured by high electricity consumption dominated by urban consumers.

Total consumption of domestic users at low voltage was 355 GWh in 1999 so that the average electricity consumption of a domestic consumer is calculated to be 1,375 kWh per year or 114 kWh per month. The number of SENELEC consumers and electricity consumption at each voltage level as of December 1999 is shown in Table 2.1

Table 2.1 SENELEC Consumers and Consumption by Voltage Level

	LV consumers			MV consumers	HV consumers	Total
	Domestic	Others	Sub-total			
Urban	230,091	92,152	322,243	870		323,117
Rural	27,961	17,946	45,907	85		45,992
Nation	258,052	110,098	368,150	955	2	369,109
Electricity Consumption	355 GWh	159.2 GWh	514.2 GWh	384.1 GWh	71.7 GWh	970.0 GWh

Source: SENELEC

High electricity consumption of a SENELEC consumer can be compared to the yearly consumption of a typical rural consumer of non-electrified village, using a Solar Home System (SHS) of 50 WP. The yearly consumption of a rural consumer is assumed to be 73 kWh (=50W × 4 hours/day × 365 days). This implies that the privatized SENELEC basically favors the area where users with high demand are collectively located, rather than the area where users with low demand are sparsely distributed.

SENELEC will be continuously constrained by generation capacity and its legal position of bulk purchaser, transmission and electricity sale. It is likely that the future electrification of SENELEC will mainly focus on improvement of service rates in the already electrified area. The conceptual flow to represent the indicative direction of the future SENELEC electrification is illustrated as follows: SENELEC would probably take interest in rural users with high electricity consumption, adjacent to existing grid in rural area.

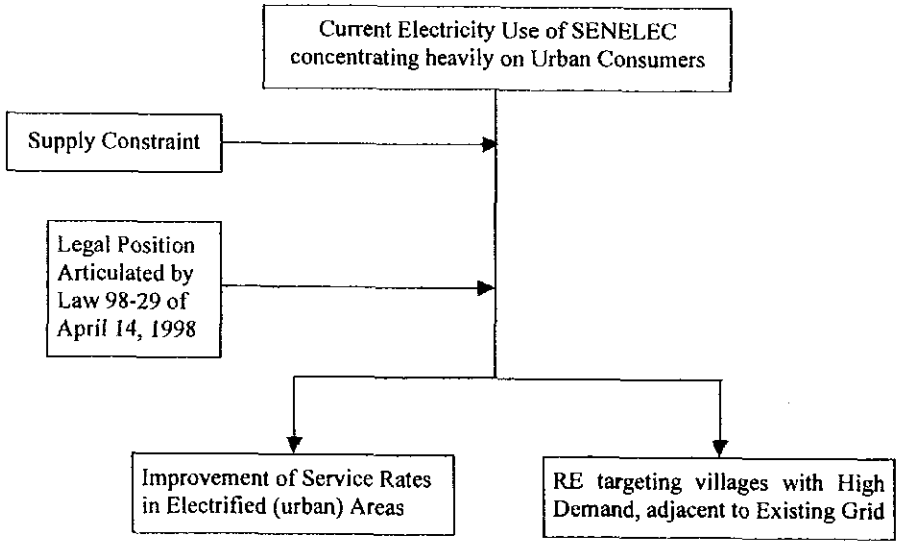


Figure 2.2 Indicative Direction of Future SENELEC Electrification

As of October 2000, the available capacity of power plants owned by SENELEC is reported to be about 300MW, consisting of diesel (102MW), steam turbine(84MW) and gas turbine(114MW). Most plants have been used for more than 20 years, and gas turbines are in particular obsolete, installed more than 30 years before. The periodical overhaul of old plants requires a careful plan of load dispatching to existing users against a growing power demand. Energy supply has been marginally sufficient to meet demand up to 1998. The following table shows historical records of energy supply and demand between 1991 and 2000.

Table 2.2 Historical Energy Supply and Demand

unit: Gwh

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Supply	915	1,000	988	1,020	1,080	1,154	1,241	1,300	1,322	1,044
Demand	737	809	794	865	884	922	1,006	1,074	1,369	1,063

Source: SENELEC

Senegal began to be in short of electricity in the year of 1999 onwards, as shown in Table 2.3

Table 2.3 Monthly Electricity Supply and Demand

Month	1999			2000		
	Production (MWh)	Demand (MWh)	Deficit (MWh)	Production (MWh)	Demand (MWh)	Deficit (MWh)
January	102,002	102,561	559	102,006	102,375	369
February	100,845	102,454	1,605	100,850	101,950	1,100
March	116,235	119,023	2,788	116,239	116,379	140
April	101,117	102,591	1,474	113,723	113,925	202
May	107,003	110,095	3,092	115,406	115,482	76
June	106,791	114,337	7,546	120,484	120,892	408
July	110,749	127,774	17,025	124,831	130,551	5,720
August	107,641	115,964	8,323	130,376	132,836	2,460
September	117,292	119,833	2,541	120,283	128,837	8,554
October	125,243	126,296	1,053			
November	114,814	115,981	1,167			
December	112,695	112,752	57			

Source: SENELEC

Demand surpasses supply in the year of 1999 onwards. The shortage of energy supply is adjusted by a careful plan of load shedding or supplied by an IPP doing the bulk sale of electricity to SENELEC. The shortage of power supply constrains the further development of national electrification.

The Article 19 of the Law 98-29 issued on April 1998 regulated the role of SENELEC as "exclusive bulk purchase, transmission and electricity sale". SENELEC was allowed to own generating facilities available on the effective date of this law. In other words, SENELEC will be no longer allowed to own new power plants. Energy supply to meet increasing demand will entirely depend on bulk sale of electricity from IPPs based on power purchase agreements.

The "less cost (transmission and distribution) and high return(electricity revenue)"will be undoubtedly the basic principle of future electrification. Improvement of electricity service rates in electrified areas definitely meets this principle. Perhaps rural electrification will be not prioritized in the business policy of SENELEC. Villages under the target of RE plan of SENELEC would be those with high demand, adjacent to existing grid.

2.3 Historical Performance of PV Projects

(1) Senegal-German Project/GTZ

The Senegal-German solar energy project started in 1989 and adopted on evolutionary approach that could contribute to the development of photovoltaic technology in Senegal. The summary of the GTZ project is owed to the brief document about the GTZ solar project, prepared by Mr. Assani Dahauenon who was the project manager. GTZ installed the following technical components:

i) 2 solar power stations (20 KW and 24 KW each) in two villages of Diaoule and Ndiebel having 2000 inhabitants each,

ii) 6 pumping systems (2.5 KW and 4.8 KW each)

iii) 10 institutional (school, primary health care, etc) system (0.5 KW to 1.2 KW)

iv) 1,600 solar home system (50 WP each)

Because of high investment cost, economic viability of the central system was not sustained compared to diesel generator but was marginally sustainable compared to the extension of MV lines. Economic viability of the pumping system was reported to be sustainable up to the hydraulic power of 1,300 m^3/day compared to thermal pumping

system. High financial cost per kWh (around US$3) of the central system made it difficult for a village organization to operate the project, giving the lesson that financial justification of the system is utterly difficult for any size of project in anywhere. SHS was, nevertheless, widely sold and diffused on credit system at the initial stage. But the devaluation of CFA in January 1994 raised the purchase price from CFA185,000 to CFA 325,000 to 500,000. Despite of such a negative trend, the large sales of SHS as 1,600 unit led to the government expectation that SHS would be a probable RE option in the future.

The other things to be borne in mind in the context of GTZ project was I) development of an association called FOPEN engaged in operation and maintenance, ii) continuous training for engineers and technicians, and iii) the creation of a technical committee (CT13) for solar energy inside the Senegalese Institute for Standardization. FOPEN was highlighted as the first local operator having 12 offices currently. The association is regarded as the GTZ asset and is still existent as a professional organization specialized in operation and maintenance of solar energy (SHS). FOPEN has developed technical expertise and established its management skills, and now would like to gain bargaining power with suppliers. But internal cohesion insider the association is weak and desired to be strengthened. Capacity building is the most significant element for sustainability of PV development in this country. Priority was placed on continuity of training of engineers and technicians. GTZ actually provided training program and equipments with CNQP and CFQT where applicants for electrical engineering including PV are efficiently trained. GTZ also contributed to standardization of SHS and created a laboratory for the quality control of SHS and its components. In particular, the technical committee (CT13) for solar energy contributes to upgrading of local standard to the world standardization.

(2) Senegal - Japan Solar Energy Project

The introduction of SHS system and central PV system, and experiment of the desalination plant operated with PV system was expected by the Senegal – Japanese Solar Energy Project. However, the introduction of SHS system was omitted from the project and number of the target villages electrified with the PV central system were also reduced, due to the reduction of the project budget after the devaluation of CFA in 1994.

Due to the difficulty of the grid extension, five villages located in remote islands were selected for the target villages for the PV central system. These villages had invested their own money in the electrification with autonomous diesel generators. Because of the machine trouble, these villages requested assistance from the Government of Senegal. The

Government of Senegal inferred from the above situation that village people had the payment capacity. Consequently, these five villages were selected for the project sites. The hybrid power generation system with PV and diesel generator was adopted for this project. Whereas the central station of the Senegal - German Project was operated by the village organization, this hybrid power centers were managed by SENELEC's staffs assigned on this project, and any village organization wasn't organized. Although the operation cost including depreciation is estimated around US$ 2.5 to 3, the electricity charges is adopted regular rate of the SENELEC (CFA 100 for the first 40 kWh and beyond that range, CFA 140 for each kWh). However, the collected rate of the electricity charge was only 54% during the one year from 20 October 1998 to 20 October 1999 (See Table 2.4).

Table 2.4 Payment Condition of the Electricity Charge of the Senegal-Japan Project

Project site	No. of users	Amount of Consumption		Amount of collected bills	Amount of unpaid charge
		KWh	CFA with Tax		
Basl-Bassar	163	38,919	4,430,500	3,506,640	923,860
Djirnda	23	8,233	895,930	0	895,930
Dionewar	84	10,220	1,173,210	564,630	680,580
Niodior	56	21,259	2,410,310	752,870	1,657,440
Total	326	78,631	8,909,950	4,824,140	4,157,810

Remarks: The data was recorded from 20, October 1998 to 20 October 1999
Sources: SENELEC

2.4 Basic Structure of RE Plan

(1) RE Plan

The PASER consists of three stages:

Preparation Stage (1999-2000)

ASER prepared for the guideline and procedures(Manual) for RE plan, institutional aspects and implementation framework of ASER-assisted rural electrification.

Launching Stage (2001-05)

The RE sub-sector will provide electricity service with 104,000 rural users consisting of new users(74,000) and existing ones(30,000).

Service Types	Existing	New	Total
Densification of electrified villages	27,000	31,000	58,000
LV distribution from generators	-	26,000	26,000
PV modules	**3,000**	**17,000**	**20,000**
Total	30,000	74,000	104,000
Rural population (2005)	5,916,000		
Rural households (2005)	696,000		
RE rate	**15%**		

The target rate of RE is expected to be nearly 15% in 2005. Out of new consumers (74,000) SENELEC's contribution will be about 42% indicating somewhat an ambitious plan of new subscribers. Those would cover 307 regional centers with the average service rates of 60%. LV distribution from generators will be implemented by private operators through tender calls, consisting of an extension of LV line from a secondary MV station (SENELEC) and autonomous generators. Out of new PV consumers(17,000), ASER anticipates 5,000 users to be commercial customers (direct cash or credit purchase) and 12,000 users to be supplied from concession holders based on the fee-for-service or equivalent modes.

Consolidation Stage (2006-2015)

The RE sub-sector will provide electricity service with 270,000 rural consumers consisting of existing (104,000 as of 2005) and new (166,000).

Service Type	Existing	New	Total
Densification of electrified villages	58,000	30,000	80,000
LV distribution from generators	26,000	94,000	120,000
PV modules	**20,000**	**50,000**	**70,000**
Total	104,000	166,000	270,000
Rural Population (2015)	6,888,000		
Rural Household (2015)	810,350		
RE rate	**33%**		

The target rate of RE is expected to be 33% as of 2015. At this stage, the contribution of a LV distribution to RE is expected to be the biggest, 44%. The non-SENELEC service (generator + PV) would contribute to 70% of RE while the contribution of SENELEC would go down from 56% as of 2005 to 30% in 2015.

(2) Mode of RE Implementation

ASER preparedthe "procedure Manual" during the preparation stage (1999-2000) and finalized it in the first quarter of the year 2001. Two (2) options are presented as the mode of RE implementation.

Priority Rural Electrification Program (PPER)

PPER means priority programs to be selected based on the Local Electrification Plan (prepared by ASER) and the National RE Plan (prepared by ASER and approved by MEH and Electricity Sector Regulatory Commission). Concessions of PPER are to be allocated into eligible concessionaires through annual tender calls. The administrative procedure to determine PPER is given below:

Procedure	Remark
Five years up-dating of National RE Plan	Rural communities to be electrified with connection (electrification) rate will be updated by referring to electrification progress and SENELEC grid extension. The interval of such an updating is 5 years, to be approved by MEH and Regulatory Commission.
Local Electrification Plan (LEP) is to be commissioned to local consultants through tender call	Though "Procedure Manual" does not define area for LEP, LEP is supposed to be prepared for area to which a concession is given. LEP must reflect the potential number of users with capacity-to-pay of them, and the number of industrial/commercial/crafts industry. Electricity sources (MV line, mixed generation, etc) should also be clarified.
Selection of PPER	The size of PPER to be selected based on LEP would be the number of potential users or of rural communities to be implemented within two or three years. Accordingly a PPER implicitly indicates a group of 2 to 3 rural communities.
Allocation of PPER concessions to successful bidders	Bidders are evaluated from both technical and financial aspects. The provisional successful bidder is invited to negotiate with ASER about the draft financing arrangement. A PPER concession is finally given to the successful bidder with approval of the Regulatory Commission.

Rural Electrification Project (ERIL: Electrification Rurale d'Initiative Local)

ERIL is considered the bottom-up or local initiative-based project to be implemented by local communities, users' association, local operators or NGOs. Unlike service companies doing electricity services of PPER, local bidders of ERIL projects are supposed to be lack of technical and financial knowledges about projects. Administrative procedure of ERIL presented in the "Procedure Manual" is shown below:

Procedure	Remark
Notification of project proposal	Any bidders taking interest in ERIL are free to submit technical proposals to ASER. The submission of proposals is twice in a year, the first between June 1 and 30, the second between December 1 and 30.
Selection of proposal	Project promoters (PP) submit proposals to ASER. Proposals include geographical area, identity of PP, target financing and CVs of project staffs. ASER their ranks the proposed proposals with the assistance of consultants and evaluates financial assistance from PP based on budget forecast and eligibility of financial assistance, and finally select the best proposals conforming with eligibility of ERIL projects.
Technical support of ASER for planning of selected ERIL projects	Upon selection of proposals, ASER is ready to prepare TOR for planning of ERIL projects elected. Local consultants make contract with ASER to undertake the detailed planning of projects selected. A wide coverage of technical support can be expected from ASER. It covers demand analysis, promising technical options, financial analysis and proposal (loan, subsidy), document writing for license or concessions, operation and management system.
The duration from notification to technical support of ASER would not exceed one year.	
Submission of project financing	Based on the detailed LEP, project promoter (bidder) request project financing to ASER.
Final selection of ERIL projects	ASER evaluates technical and financial aspects of ERIL projects proposed, financial proposal in particular.
Financial agreements	ASER then shifts to the detailed negotiation of financing convention with bidders, covering loan, subsidy, banking system.
Allocation of ERIL concessions	The successful bidder submits an application of ERIL concession to MEH and get the full right for ERIL project upon approval of MEH and Regulatory Commission.

(3) Concessions

The final version of "Procedure Manual" proposes area and size (in terms of potential users) of concessions. The number of concession turns out to be eighteen (18) in total. A concession area is basically equivalent to a department while a few concession cover two (2) or three (3) departments, depending on the number of potential users. The ASER makes rough estimation of connection rtes to estimate potential users in the future RE market. The connection rates are estimated by population range of a village as follows:

Connection Rates (1)

Population size		P>1,000	500<P<1,000	250<P< 500	P< 50
Connection rates	(%)	40	30	20	10

Connection Rates (2)

Population size		P>1,000	500<P< 1,000	250< P<500	P<250
Base connection	(%)	30	20	10	5
Maximum connection	(%)	60	40	30	25
Economic activity	(%)	+15	+10	+10	+10
External resources	(%)	+5	+5	+10	+10
Proximity to urban	(%)	*+10*	*+5*	*+0*	*+0*

The connection rates (1) simply assumes those by size of village population. The connection rates (2) adds a few criteria to (1) in order to estimate the maximum connection rates. Criteria consists of economic activity, external resources and proximity to urban area.

Based on the connection rates of (1) and (2), the "Manual" estimates potential users by concession area as of the year 2011. Potential users in 2011 are estimated to be 156 thousands and 202 thousands respectively. The RE rate in the case of maximum connection rates is estimated to be 29 percent as of 2011. The average number of potential users per concession area is calculated to be about 10,000, which appears to be large enough for a private company to do business of electricity supply service.

Number of Potential Users by Concession Area (As of 2011)

No.	Region	Department	Nos of users in connection rate of (1)	Nos of users in connection rate of (2)
1	Ziguinchor	Bigona-Oussouye-Ziguinchor	7,844	9,575
2	Diourbel	Diourbel-Banbay	7,329	10,852
3	Diourbel	Mbacke	13,808	18,698
4	St Louis	Dagana-Podor	9,169	9,160
5	St Louis	Matam	9,735	11,201
6	Tambacounda	Tambacounda – Kedougou	6,109	9,082
7	Tambacounda	Bakel	5,310	6,296
8	Kaolack	Kaolack-Nioro du Rip	9,390	13,317
9	Kaolack	Kaffrine	9,580	13,865
10	Thies	Tivoouane	8,768	10,006
11	Thies	Thies	8,938	11,357
12	Thies	Mbour	9,684	9,802
13	Louga	Kebemer-Louga	5,016	6,163
14	Louga	Linguere	7,146	10,162
15	Fatick	Gossas – Fatick	10,339	14,152
16	Fatick	Foundiougne	5,142	6,094
17	Kolda	Sedhiou	8,815	12,602
18	Kolda	Kolda-Velingara	6,224	9,537
	Total		148,346	191,921
		RE Rates (%)	22	29

The provisional plan of RE implementation expressed by concession areas is given below.

1st	2001	Dagana-Podor, Mbour, Kolda-Velingara
2nd	02	Foundiougne, Kaolack-Nioro du Rip, Sedhiou
3rd	03	Matam, Bakel, Ziguinchor
4th	04	Tivaouane, Kebemer-Louga, diourbel-bambey
5th	05	Tambacounda-Kedougou, Kaffrine, Gossas,-Fatick
6th	06	Linguere, Mback, Thies

ASER starts with the bidding for Local Electrification Plan of Dagana-Podor, Mbour, Kolda-Velingara in the first tranche in order to select concessionaires in the year of 2001. The reasons for selection of these concession areas first are i) concentration of villages whose population is more than 1,000, ii) distribution of relatively high income users, and iii) potential area for LV network. Kolda-Velingara would be the target area of French ODA. The allocation of concessions to successful bidders is expected to end in the year of 2006.

(4) Financial Mechanism

The project costs consisting of the initial investment are to be financed by the government budget, international loan with concessionary interest/bank loan, private capital from service companies or investors, and users' capital. The standard allocation of investment cost to the sources of fund is depicted as follows:

Loan (70%) **(International or Bank Loan)**	**Private Capital (20%)**	**UC (10%)**

Legend: UC (Users' contribution)

RE may be risky to banks owing to high probability of borrower's (mostly service companies) default because of non-productive business. Banks are accordingly reluctant to lend their fresh loan to borrowers at the initial stage. The large part of investment cost is to be financed by international loan with concessionary interest. It is reported that the International Development Agency (IDA) is scheduled to lend US$52 million to the government of Senegal for RE only. International loan takes the form of refinancing in which the government represented by ASER will take the full responsibility of fund

management. The West African State Central Bank (Banque Centrale des Etats de l'Afrique de l'Ouest called BCEAO) would be in charge of fund management and on-lends to the main banks in compliance with ASER's guidance or financial convention agreed between ASER and banks.

Financial position of ASER is to be strengthened owing to fresh input of international loan, thereby ASER is ready to use such loans for various objectives. Subsidy is still under argument in terms of how far investment is to be financed by subsidy. Without subsidy, the monthly fee paid by a user tends to exceed his energy expenditure at the time of non-electrification. Subsidy is therefore necessary to ease financial burden on a user. The Procedure Manual presents theoretical background and recommended rate of subsidy. The recommended subsidies of SHS are shown below though theoretical background for them is not fully spelled out. This matter remains to be discussed.

Recommended Subsidies for SHS

SHS	Cost (FCFA)	Subsidy (FCFA)	Rate (%)
50Wp	405,000	80,000	20
		60,000	15
		40,000	10
35Wp	340,000	80,000	24
		60,000	18
		40,000	12
22Wp	220,000	80,000	36
		60,000	27
		40,000	18

Source: Procedure Manual (Vol. 3)

Many factors have to be taken into account to determine subsidy rates to be recommended. They are purchasing power of rural consumers, locations (remote area) and financial position of a private company (operator). Provided that a subsidy rate of a project is determined to be 50%, share (%) of fund sources would be as follows:

Loan (20%)	Subsidy (50%)	Pr. (20%)	UC (10%)

Legend: Pr (Private capital), UC (Users contribution)

Subsidy is disbursed to service companies (or operators). Loan would be from either banks or ASER refinancing. Refinancing quota depends on loan conditions, 100% for

long-term, 80 to 100% for the middle-term, and 25% for short-term. In the case of the less subsidy rate, guarantee fund is to be necessary for banks as a risk hedge against the default of repayment by borrowers. In the case of high subsidy rate, the necessity of guarantee fund could be minimal.

Financial transaction is schematically illustrated in the following figure in which ASER's refinancing is included.

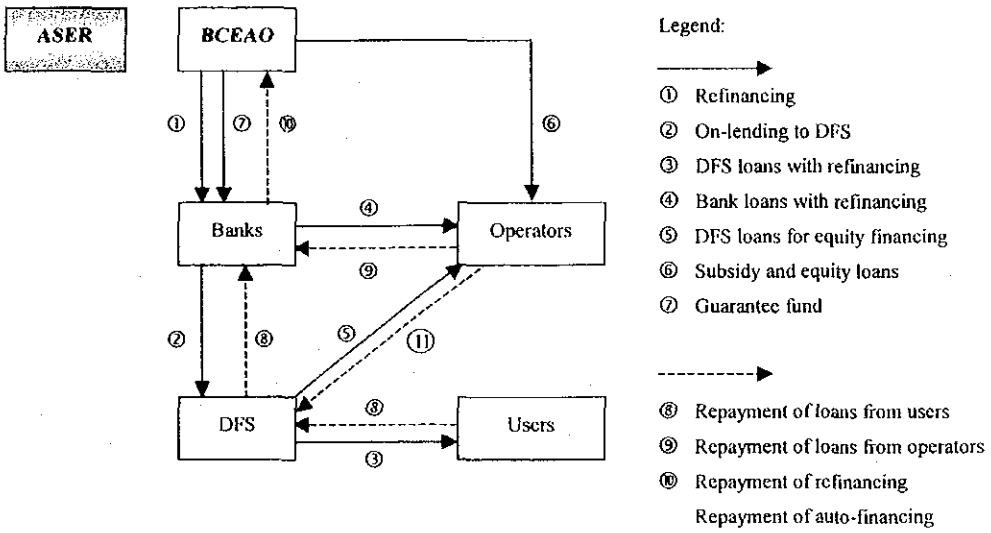


Figure 2.3 Financial Mechanism for Rural Electrification

(5) Stakeholders

ASER is an autonomous body under the Ministry of Mines, Energy and hydraulic (MMEH) established by the decree of No. 99~1,254 issued on December 30, 1999. ASER has operational and institutional relations with MMEH, the Regulatory Commission of Electricity Industry, the Ministry of Finance, financial intermediaries, concession-holders, local communities and so on.

1) MMEH

As stipulated in the orientation law of 98~29, the licenses and concessions shall be granted by the Minister together with agreement signed by the Minister and the holder of such license or concession. The MMEH currently has four (4) departments under the Minister, out of which the Department of Direction is responsible for

policy and plan of energy development including power and renewable energy. The main tasks in relation to RE include:

- Elaboration and periodic upgrading of the national electrification plan,
- Monitoring and evaluation of PASER including progress of GIS data base, and
- Advisory tasks concerning to monitoring and evaluation of PPER and ERIL conducted by ASER.

2) Regulatory Commission

A Regulator Commission for Electricity Industry was established as an independent public authority, responsible for regulating all operations relating to generation, transmission, distribution, and sale of electricity. The Commission consists of three members appointed by decree in the areas of law, technology, economics and their expertise with respect to electric industry. The main tasks in relation to RE include:

- Proposal of issuance of license or concession to the Minister of MMEH
- Regulation of power rates (together with the Minister of MMEH)
- Recommendation of revocation of license or concession to the Minister of MMEH in case holders seriously violate legal and regulatory obligations,

3) Ministry of Finance

The Ministry of Finance is primarily responsible for allocation (budgeting) of internal revenues and special taxes to RE. Public financial resources are presumed to be disbursed to the central bank (BCEAO) for mobilization of subsidy or guarantee fund.

4) Concession-Holders

The term "concession-holders" is synonymous with operators undertaking RE business in the framework of PPER or ERIL. Two types of holders can be considered for PPER. One is distributors constructing MV extension line and LV network. They purchase electricity from SENELEC and sell electricity to consumers. The other is commercial companies or investors or a combination of them

constructing diesel-based mini grid network (LV) or installing PV (SHS). While holders of ERIL are presumed to be NGOs, local entrepreneur and possibly highly trained village organization.

5) Local Communities

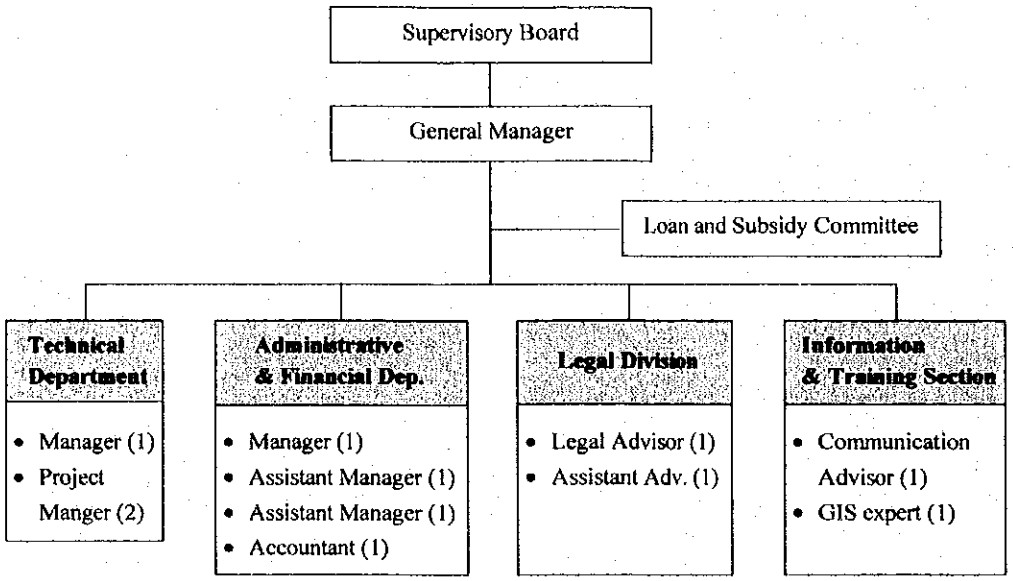
The term "local communities" is somewhat ambiguous. In the Procedure Manual, this term implicitly indicates project promoter (operator) of ERIL projects. The interpretation of local community is desired to be extended, including resident technician and village organization. These stakeholders residing in villages are also key players of project operation.

6) Financial Institutions

BCEAO is scheduled to open a special account for RE's financial resources consisting of the government budget and international loan from the World Bank. Financial intermediaries are broadly classified into commercial banks and decentralized financial institutions. Commercial banks are, for example, BICIS (Internal Bank for Trade and Industry), CBAO (West African Bank), SGBS (Association of Banks in Senegal) and CNCAS (Senegalese Agricultural Credit Bank). The decentralized financial institutions are represented by ACEP (Alliance of Credit and Saving for Production) and CMS (Senegalese Mutual credit Fund). CMS is probably expected to be the key institution in the RE's financial framework, extending refinancing loan to project operator of ERIL or end-uses directly.

7) ASER

There are 16 staffs with the different professional fields working at ASER as of October 2001. Internal structure of ASER is planned to consist of:



- Supervisory Board : The Board acts as the decision-making body for approval of RE programs, determination of loan ceiling and subsidy rates and any resolutions relating to ASER's actions
- Loan/subsidy committee : The Committee is in charge of evaluating loan amount and subsidy rates for both PPER programs and ERIL projects
- Technical Dep. : The Department is basically responsible for elaboration of Local Electrification Plan and for monitoring and advisory works on PPER and ERIL.
- Administrative/ Financial Dep. : The Department is responsible for agreements of financial convention and contracts approved by supervisory Board and is also financial management of all RE programs.
- Legal Division : The Division is liable for legal conditions relating to financial conventions and contracts.
- Information/Training Section : The Section is in charge of dissemination of ASER activities to the public, development of GIS-data base

2.5 Basic Strategy for Private Initiative-based Rural Electrification

The following is a basic policy of ASER for the rural electrification.

ASER's objectives

The stake in electrifying rural areas can be expressed economically, socially and in terms of land adjustment. Over-population of some of our towns and particularly Dakar, is a trend that urges a progressive inflection to be generated by a global rural development strategy, in which rural electrification will be one of the main vectors for irrigation development, education, health, fishing, tourism etc., and a restoration of an optimized balance between towns and rural areas.

Regarding the weakness of the electrification rate in rural areas (8%), the Senegalese government has undertaken a new dynamic in order to achieve ambitious objectives by setting up a new organizational device in which the Senegalese Agency for Rural Electrification (ASER) is a very important component. Its mission is to promote rural electrification by sustaining local initiatives and carrying out electrification projects based on the Senegalese Rural Electrification Action Plan (PASER) adopted by the Government in 1999.

The implementation of this action plan was scheduled in three phases :

- a preparation phase 1999 – 2000, corresponding to setting up of the structure and the preparation of the launching phase,
- a launching phase 2001 – 2005, in which the main objective will be to reach an electrification rate of 15% that represents access to electricity for 100 000 new rural households,
- a consolidation phase 2006 – 2015, in which the main objective will consist of intensifying the rhythm of the realizations achieved during the launching period. This will help us to achieve a minimum rate of 30% by year 2015, meaning electricity for 270 000 rural households that represent 70% of Senegalese Rural Communities.

ASER's Approach

Division of the country into rural electrification concessions and involvement of private sector

The organisational scheme adopted to implement rural electrification projects is based on the division of the country into 18 rural electrification concessions, with around 10 000 potential customers per concession. ASER will launch three invitations to tenderers each year, to select one private operator for each concession, who will be in charge of implementing priority rural electrification projects of the Government, based on a contract with ASER which precise a clear rural electrification development rhythm in the concession. ASER will be in charge of controlling the proper execution of the contract with the operator.

At the level of the village, the private operator will be relieved by a local operator for the exploitation of local low voltage grid. This approach present the advantage to reduce considerably the cost of managing customers.

Priority and local initiative rural electrification projects

In the ASER approach, two types of rural electrification projects are considered: The priority rural electrification projects (PPER) decided by the Government, under the delegate project ownership of ASER, and also rural electrification projects from local initiative (ERIL, from NGOs, local associations or local communitie) The ERIL projects can benefit from the technical and financial assistance of ASER.

Financial assistance from ASER

Important subsidies and credit from ASER are indispensable to attract the private operators' equity participation in the rural electrification, which has been regarded as social development.

Adaptation of grid technical standards

Oversized technical standards represent an important brake to rural electrification expansion in Senegal, because of the corresponding high cost of investments. New sizing and design of grids through a linging up to the low levels of electricity demand in rural areas strongly reduce the cost of investments for rural electrification. But this operation must take in account the furure increase in the electricity demand levels.

A strong communication component

The actors targetted through the communication component are various:

- Households,
- Local communities,
- Potential private operators,
- NGOs and local associations,
- Bankers and donors,
- Decision makers

This justify a multimedia strategy of communication, based on:

- Meetings with rural community leaders,
- Radio animation in local languages,
- Brochures and audio-visual documentaries and reports,
- Quaterly connection bulletin between local communities, customers associations, investors, public administration and other partners for development,
- TV mass addresses and debates towards populations and deciders,
- Local training workshops (for rural counselors and local associations and NGOs),
- A WEB site,
- Annual activities reports.

Concessions approach, involvement of private sector, financial assistance to PPER operators, financial and technical assistance to ERIL projects, adaptation of technical standards, strong information and communication campains, should together lead ASER to reach the senegalese rural electrification objectives.

The ASER rural electrification program is one of the main national strategy to fight against poverty.

ASER's Validation Seminar

The validation seminar was held on March 28 and 29, 2001, in which ASER formally announced its policy towards the execution of global rural electrification and addressed the above-mentioned ASER's objectives and approach. Participants in the Seminar, the list of which is given in the attachment, came from government ministries and agencies concerned, financial institutions, energy-related suppliers, consultants, regional cooperatives, NGOs, specialists in the energy sector, etc.

The produced results in this Seminar are given in the attachment. (Annex B and C)

2.6 Basic Strategy for PV Rural Electrification

Under the right conditions, SHS can offer lighting and other services to large numbers of households that are poorly served by existing energy sources or have no service at all. PV systems are an effective complement to grid-based power, which is often too costly for sparsely settled and remote areas. For such rural conditions, fuel-independent, modular solar home systems (SHS) can offer the most economical means to provide lighting and power for small appliances.

As a renewable energy source, PV systems are also environmentally friendly, contributing to reduction in environmental performance and reduce reliance on expensive imported fuels.

In spite of these appealing features, solar home systems do not yet have broad market acceptance and face significant barriers to widespread diffusion. The main obstacle is their

initial purchase price, which puts them out of the reach of all but upper-income households. Opportunities exist to reduce the cost of solar home systems over the near future. These include the outlook for steady decline in PV module prices on the international market, and the economies of scale in procurement, sales and servicing that an enlarged customer base can provide. However, even with these cost reductions, unless adequate financing arrangements, geared to low- and middle-income households, are in place, solar home systems cannot play a significant role in rural electrification.

Many early solar home system programs in the 1970s and 1980s failed, due to a variety of factors. These included 1) unreliable technical performance, 2) poor system design, 3) lack of sustainable and proper technical support, 4) implementing agency shortcomings, 5) poor attention to cost recovery, and 6) unrealized user expectations and consequent dissatisfaction. As a result, thanks to the lessons learned from these experiences and from technological improvements, solar home systems now show a robust potential for long-term sustainability. In spite of wide recognition of PV systems, the need to overcome the first cost barrier is recognized to be prerequisite in any country context.

Among others, several key findings which are critical to broad diffusion of PV system in rural areas, emphasize the need to:

- Overcome the first cost barrier,
- Establish responsive and sustainable infrastructure to deliver PV services, and
- Provide quality products and services.

(1) Overcoming the First Cost Barrier

Affordable Payment Schemes Affordable and accessible financing is a major consideration in the design of any PV program due to the high initial costs of solar home systems. Affordability can be increased by providing households with term credit through local dealers or the banking system or by leasing or energy service company (ESCO) arrangements.

Here in Senegal, the latter scheme of "fee for services", corresponding to energy service company (ESCO) arrangements, is planned to be introduced for promotion of the rural electrification. This scheme will be initiated and facilitated by ASER, which has been created as an agency responsible for rural electrification. Its principal purpose will be to

promote rural electrification and, to this end, to provide technical assistance and financial support required to carry out rural electrification projects represented by PPER and ERIL. Such judicious use of subsidies and concessionaire loan as financial support, could help implement household PV programs. To assure sustainable programs, such assistance should be also used to build market infrastructure through planning, promotion, training, feasibility studies, quality assurance, and similar activities, or limited equity to reduce the capital costs of a project.

In addition to that, Governments should rationalize duty and tax structures, if these discriminate against PV development. Relatively high import duties (particularly on PV modules) and other taxes such as VAT, can severely limit the potential for commercially viable, market-driven solar home system programs. Tax incentives such as exemption of corporate tax and/or introduction of one-year's depreciation, may be advised to be adopted for facilitation of PV diffusion.

(2) Establishing Responsive and Sustainable Infrastructure

Institutional Structure and Identification of Potential Operators No single institutional arrangement is appropriate for every country. Looking at the socio-economic situation of Senegal, Fee for Servicemodel may be the most recommendable, being well in cope with the principle policy of ASER. It can allow for the most affordable payment schemes, and can thus reach a larger customer base than other credit delivery schemes such as leasing arrangements and cash or credit sales to consumers. With a large customers' base, the potential operators can obtain economies of scale in procurement and in the delivery of support services, make product standardization and quality assurance easier, and facilitate battery recycling. While the fee for service model is an attractive concept, its long-term viability requires business management skills and technical capabilities that may be limited in rural areas. Furthermore, the fee for service model also carries greater commercial risk due to the longer cost-recovery period represented by concession period. Therefore, the business management skills and technical capabilities are vital to the sustainable development of PV systems so that the training and the creation of potential local electric operators should be envisaged as a major technical assistance provided by ASER.

Financial Sustainability. PV programs must be operated as businesses. They should generate revenues sufficient to recover capital investment, service debt, pay for administrative and support services, cover payment defaults and, in the case of for-profit

operations, provide satisfactory returns for investors. To ensure sustainability, PV programs should:

1) set prices to allow for full cost recovery;
2) select only consumers with a willingness and ability to pay;
3) ensure that consumer expectations are in line with the energy services to be provided;
4) maintain high product quality and responsive services;
5) establish effective fee collection methods and enforce regulations to shut off service for nonpayment;
6) adopt simplified administrative procedures; and
7) choose and retain quality staff.

Effective Management and Support Services A successful PV program needs well-qualified managers and technicians. In this scheme, managers will be selected, preferably recruited locally, by the operator. Technicians, who will be locally selected from the villages, are supposed to be employed and trained by the operator. Adequate salaries are also required to retain qualified managers in rural areas. In addition, technicians must be trained in order to assure responsive repair and maintenance services, seemingly an often under-emphasized aspect of PV programs. In due consideration of global rural electrification, the potential operator, which will play a vital role in the project formulation, should be surveyed and identified based on the criteria for eligibility by ASER.

(3) Providing Quality Products and Services

Technical Quality The long-term sustainability of a PV program depends on well-designed products (including proper assembly and installation procedures) that meet consumers' expectations and capacity to pay. Low-capacity and high-quality products should be offered to those potential customers with only a limited ability to pay. Costs should never be reduced by compromising system quality or by decreasing support services. Where low-cost systems must be used, customers need to be fully aware of and accept a limited level of service.

Consumer Awareness 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) The Role of Government and Donor

Grid-based electricity has only been the mainstay of rural electrification efforts. However, the increasingly high cost of serving isolated and remote communities burdens government budgets. A large proportion of rural needs for household lighting and small power requirements can be met by solar home systems at a lower economic cost than grid service. Consumers are reluctant to purchase what is perceived to be only a short-term solution. Instead, explicit government support of solar home system programs for isolated, or remote villages, or non-served portions of electrified communities can help PV meet low load demands and prevent uneconomic extension of the rural electrification grid.

The key role of government is to guarantee an appropriate institutional and regulatory environment. Governments should rationalize duty and tax structures as well as incentive or subsidy programs to reduce market distortions and facilitate access to credit. Other governmental functions include the setting of technical standards, monitoring and disseminating information on PV technology and the performance of solar home systems. By investing directly in PV equipment as part of education, health, and other social programs, governments represented by Direction of Energy can also play an important role in establishing the infrastructure needed to sustain PV systems.

Finally, the electricity use of PV should cover lighting as well as productive use such as water pumping, refrigerator and craft industry. Nevertheless, considering that lighting is the most important purpose of rural electrification, it has been mutually agreed between JICA Study Team and MEH at the beginning stage of the Study that primal use of PV is the lighting including electric apparatus of household and public facilities (i.e. school, health post, etc.)

2.7 Role and Responsibility of ASER towards PV Market Preparation

The significant aspect common in the two models such PPER and ERIL addressed in the Procedure Manuals, is that the locally-based entrepreneur be positively involved in the

project. The local initiative approach, is quite recommendable not limited to the "Local Initiative Rural Electrification"(ERIL), but also to facilitation of the rural development itself. The major economic entity in the rural community is considered to be represented by local NGOs, local cooperatives, local owner of the small business such as boutique owner of PV equipment, etc..

In the stage when business activities initiated by rural community are very poor, access to business information is difficult due to no linkage between urban-based business group and local community. Therefore, the development process should be well considered, from several aspects such as time factor, business linkage between urban and rural inclusive of information, community empowerment, etc. as addressed in the section 4.5.

In such an initial stage, as a project promoter, the existing business entities, particularly interested in the energy industry, is expected to play a major role. In that respect, brief limited interview survey has been done on the energy-related enterprises participated in the Validation Seminar sponsored by ASER (See annex B and C)