

Chapter 14 Implementation Strategies for PV Rural Electrification

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14.1 Institutional and Policy Support Measures for Promotion of the Ongoing PV Rural Electrification Project

(1) Government Subsidy and Incentive Program for Grid Expansion and Grid Connection

BPC collects the connection fee as a lump sum payment from customers who want to receive electricity. The electric tariff does not include the cost of connection to the grid. Therefore, RCS is provided in order to pay the connection fee. RCS has been revised to make them more affordable. The up-front payments have been reduced and the repayment periods increased. Prospective customers requiring less than 35 kW of electrical power shall pay an up-front payment of five percent (minimum) of the connection fees comprising capital works and/or service costs. The balance of 95 percent (maximum) shall be paid over a period of 15 years at prime interest rate;

Regarding grid extension, the government provides half of the total construction cost if the IRR of the project is less than 6% and the government approves the project. However, the government is subsidizing 100% of the investment cost for the on-going grid extension project for 72 villages. The subsidy for the 72 villages grid-extension project and proposed subsidy for PV rural electrification business plan discussed in Chapter 13, are compared in Figure 14.1-1 on a benefited household basis.

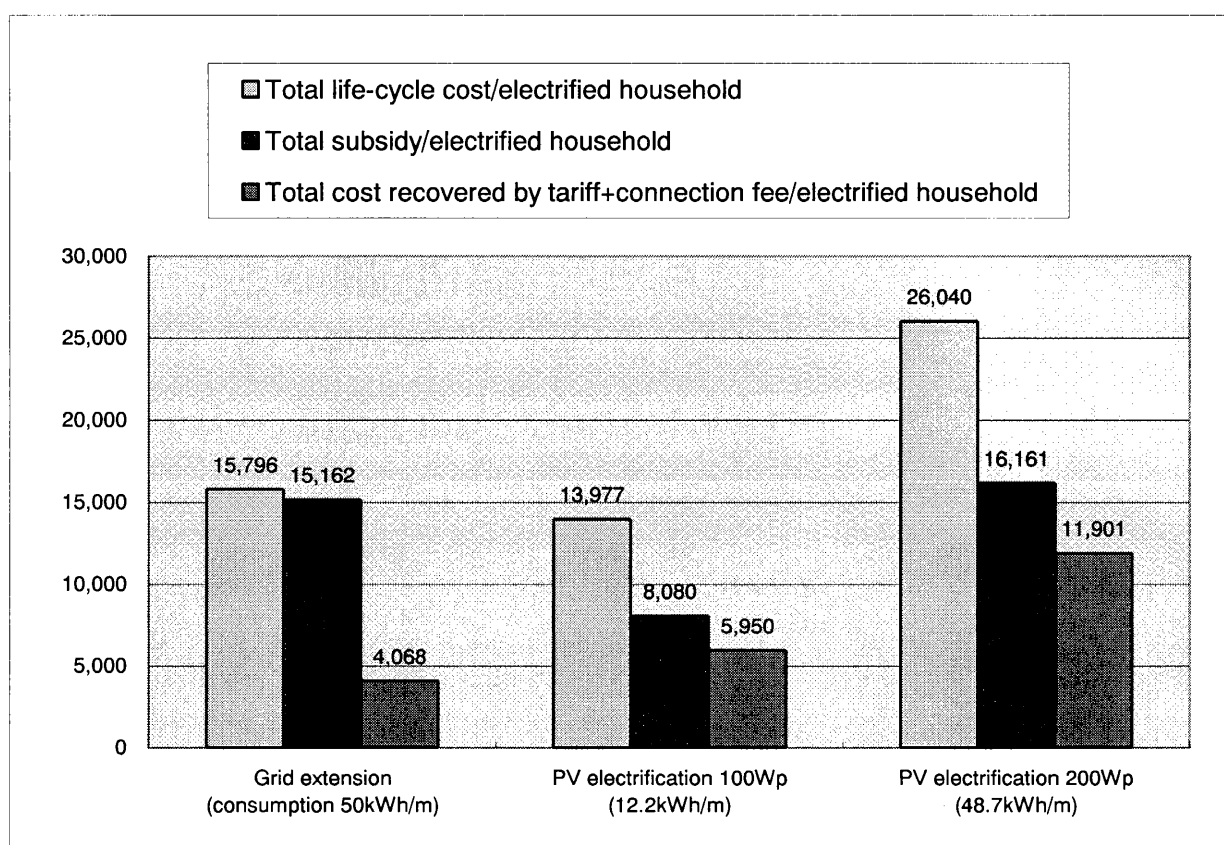
In Chapter 7, the comparison was made, supposing that the 72 villages were PV-electrified taking the case of BPC's 72 village electrification as a basis of comparison. In the comparison, total life-cycle costs were calculated both for grid extension and PV electrification.

On the same calculation basis, comparison of subsidy per household benefited by electricity supply (60% of total households in 72 village) was made. The results are shown in Figure 14.1-1.

Figure 14.1-1 shows that the subsidy allocated for grid-electrified household is almost two times more than the subsidy for the household of average 100Wp consumption level.

If the village has 200Wp average consumption level, the subsidy per household will be a little more than the one for grid.

As mentioned in Chapter 7, the average consumption level in rural area is assumed less than 200Wp and therefore, subsidy allocation proposed in Chapter 13 “PV Rural Electrification Project Plan” will be reasonable. Apart from the allocated subsidy per household, cost recovery ratio in case of proposed PV electrification scheme is much better than the one for grid electrification as mentioned in Section 7.2.3.



Note: Grid extension (Subsidy: 100% of initial investment cost excl. connection cost)
 PV electrification (Subsidy: 80% of investment. Cost incl. battery exchange cost for 12 years operation)

Figure 14.1-1 Comparison of Subsidy per Household
 (Life-cycle Cost for 20 Years at Discount Rate 15%)

14.2 Recommendations on Policy Framework and Incentives

(1) Evaluation of Current Policy Framework and Incentives

NPVREP should change from the loan approach to the ESCO approach, which can remove the barrier to access to PV system by spreading the heavy capital cost over the service life of PV system.

(2) The 10% VAT will be imposed on all goods and services in July 2001 and will likely discourage potential customers from using the PV system if it is added to the service charge, resulting in a significant decline in the electrification rate. Thus, the project should be exempted from the VAT.

14.3 Objectives and Strategies for PV Rural Electrification Master Plan

In order to accomplish the goals, the following four objectives are set forth, and strategies for accomplishing these objectives are summarized as follows.

14.3.1 Objective-1:

To supply solar electricity, quickly and under affordable conditions, to households in rural areas that cannot benefit from grid electrification and other energy supply services

(1) Strategy required for the central government

- 1) Basic policy for regional development: Improvement of social equity, development of a general framework for regional economic development, and related legislation
- 2) Establishment of an organization to promote rural electrification as part of the national development program (NECC)
- 3) Establishment of an organization to coordinate, manage and control the PV Rural Electrification Project (Management Committee of PV Rural Electrification).
- 4) Designation of the implementation body for PV rural electrification
- 5) Determination of division of responsibilities for promotion of PV electrification among related organizations
- 6) Establishment of the target electrification rate

- 7) Development of a general framework for financial support for PV rural electrification projects
 - 8) Coordination, monitoring and follow-up activities related to promotion of PV rural electrification
- (2) Strategy required for the demand sector
- 1) Socioeconomic study on villages and localities (including public facilities): Survey and assessment of local needs (requirements by potential users) and demand (portions of needs for which potential users are willing to pay as the user charge)
 - 2) Development of a comprehensive energy utilization plan including electricity on the basis of the basic plan (taking into account population and demand outlooks)
 - 3) Development of measures to maximize the effect of PV utilization
- (3) Strategy required for the supply sector
- 1) Development of a medium- and long-term grid expansion plan and a PV electrification plan on the basis of the results of analysis of local needs and demand
 - 2) Development of a transitional PV electrification plan for areas where grid electrification will likely be delayed

14.3.2 Objective-2:

To implement the PV rural electrification project at the least practicable cost and in a financially feasible and sustainable manner

- (1) Strategy required for the central government
- 1) Selection criteria for electrification projects according to priority
 - 2) Integration with the existing PV rural electrification program (NPV-REP)
 - 3) Allocation of government subsidy required for sustainable operation of PV projects
 - 4) Exemption of the VAT for PV service charges
 - 5) Exemption of import duties of equipment and materials for the project
 - 6) Development and upgrading of PV-related technology standards
 - 7) Promotion of related industries

(2) Strategy required for the demand sector

- 1) Public education and advertisement on the effective use of the PV electrification system
- 2) Institutional setup to promote electrical appliances
- 3) Promotion of active participation in the PV electrification project

(3) Strategy required for the supply sector

- 1) Establishment of selection criteria for grid and off-grid electrification projects (including PV): Optimization of an electrification system based on least cost analysis
- 2) Setting of user charge required to achieve the target electrification rate, and development of a business plan to enable sustainable management
- 3) Criteria to select PV electrification project areas according to priority
- 4) Criteria to select priority areas for rural electrification
- 5) Planning and implementation of programs to ensure self-sufficiency and sustainability of the project
 - i) Rationalization of the central implementation body and its operation (effect use of existing infrastructure, optimum manpower allocation, etc.)
 - ii) Empowerment to local organizations (first line maintenance, collection of service charge, etc.)
 - iii) Use of private initiatives
- 6) Education on PV technology to local residents
- 7) Training of service engineers within the implementation body
- 8) Education and training of first line maintenance personnel in villages

14.3.3 Objective-3:

Integration with infrastructure projects required for a specific region or area

(1) Strategy required for the central government

- 1) Development and implementation of an integration plan with other infrastructure projects that need to be implemented in parallel to the electrification project
- 2) Establishment of the recycling system for waste batteries

- (2) Strategy required for the demand sector
 - 1) Promotion of efficient use of energy including electricity
- (3) Strategy required for the supply sector
 - 1) Supply of required energy other than electricity
 - 2) Improvement of project viability using additional benefits from integrated implementation (development of additional demand and the improvement of the payment ability)

14.3.4 Objective-4:

Expansion of environmentally friendly energy use

- (1) Strategy required for the central government
 - 1) Development of public support policy for prevention of global warming, and evaluation of externality
 - 2) Promotion and coordination for use of reusable energy
 - 3) Development and promotion of technology and equipment using the reusable energy, including the PV system
 - 4) Legislation and legal control to promote the establishment of the recycling system for safe disposal of lead/acid batteries
- (2) Strategy required for the demand sector
 - 1) Public advertisement on efficient use of energy including electricity
- (3) Strategy required for the supply sector
 - 1) Development of future PV strategy for various applications for prevention of global warming
 - 2) Development and promotion of technology and equipment using the reusable energy, including the PV system
 - 3) Legislation and legal control to promote the establishment of the recycling system for safe disposal of lead/acid batteries

Chapter 15 Monitoring Results of the Dissemination Project

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15.1 BPC's Operation Management

The Project Team headed by Mr. Motsepe was nominated in BPC head office. Basically, operation and management were done on a lateral organization (matrix organization) basis

The responsible local offices for the Dissemination Project are as follows:

Selibe Phikwe Office	: Motlhabaneng
Makalapye Office	: Kudumatse
Head Office (except financial matters)	: Lorolwana
Jwaneng Office	: Lorolwana (financial matters)

One commercial officer and two technicians are assigned in each local office. Technicians visit the site approximately once two weeks.

15.2 Services Rendered by Contractor (SIB)

SIB has repeatedly visited the three sites upon BPC's requests. They have supplied customer services and training of System Monitoring Agents in the villages and they grasp well the needs and complaints of the users.

15.3 Operation Status in the Three Villages

There are in each village the sales agent who vends prepaid cards (normally a general store who concluded a contract for the agency with BPC) and the System Monitor Agent who concluded a contract with BPC for first-line maintenance for the users. They are working steadily, although their procedures and forms for work record should be improved.

In Motlhabaneng, a lady was assigned as a System Monitor Agent. She bought a black-and white TV and fixed a telephone after her assignment. She has been doing good job although her technical training is required furthermore.

In Kudumatse, a chief's nephew (25 years old) are doing maintenance work in parallel with his welding work. He has enough capability of supplying first line maintenance

for users. There is no telecommunication measure with BPC's local office and he sometimes visited Mahalapye office (50km apart) to report and to receive his salary. However, Chief's daughter has taken his place since October 2002 because of his death.

In Lorolwana, a capable middle age person was assigned as System Monitoring Agent and he is operating BCS.

Revenue collection is done surely by the Sales Agent in each village.

Theft has not occurred in the three villages. Generally speaking, Operations are judged to be successful beyond expectations.

15.4 Status of Revenue Collection

Results of revenue collection in the three villages are shown in Appendix Table 15.4-1. Kudumatse showed the best record. Average revenue collection rate between April 2002 and December 2002 is 93.0%. There are two long-term defaulters to whom PV systems were repossessed (Repossessed user). Average revenue collection rate rises to 94.6% if such repossessed users are excluded from the number of users. Motlhabaneng showed average 84.6% collection rate. There are three repossessed users. Average revenue collection rate rises to 89.0% if such repossessed users are excluded. The worst records are in Lorolwana. Average collection rate is 77.1% and there are six repossessed users. Average revenue collection rate rises to 84.6% if such repossessed users are excluded. Average collection rate in 3 villages is 85.3% while that excluding repossessed users is 89.7%.

The status of BCS operation is very bad. Revenue collection rate is 39.4% at the original number of BCS users of 41. However this rate rises to 47.5% if the number of BCS users is counted as 34 users who are currently using BCS. Tariff system has been modified since October 2002 aiming at the improvement of the revenue collection. Since it is supposed that the tariff system change has not been well instructed to BCS users, many of them enjoys this system without paying the fixed charge. Therefore the revenue collection rate is still low. The frequency of battery charging was as low as 70~100 times per month. This was corresponding to 2~3 times/user-month, which is far below expected as 10 times/user-month

The common problems among users are as follows:

- (1) Most of the defaulters left village for a long period due to their assignment in other urban villages or town (such as school teacher and policeman), or their works in cattle posts and crop fields.

BCS defaulters are those who left the village for their works in their cattle posts. They have complaints of their obligation to continue to pay tariff during such absence.

- (2) The cash they have is so scarce that they cannot vend the prepaid card at their due day. Therefore, the system is sometimes off during such unpaid period.

15.5 Countermeasures for Revenue Collection Improvement and Smooth Operation of the Project

The following countermeasures were taken for the revenue collection improvement and the smooth operation of the project in July 2002.

- (1) Countermeasures for defaulters

- a) There exists some defaulters who has been in arrears for a long term from the commencement of the project mainly due to a long absence in the village. Since it is considered that the revenue collection would be quite impossible, PV systems are to be removed according to the contract for those in arrears for more than 3 months.

- b) As the original tariff system (Fixed tariff system P15/month) raised unfairness claims among BCS users, the tariff system for BCS is to be modified as follows.

Fixed tariff : P5/m

Tariff for charging : P1/charge

(Above counter measures have been executed since October 2002)

- (2) Operation, Management and Control

- a) Retraining of BPC's local Officers and System Monitoring Agents was done at BPC's training center.

- b) Use record forms was suggested by the Study Team

- c) In order for BPC to modify the system (such as relocation of Conlog and system removal), SIB sent confirmation letter to BPC that SIB's guarantee obligations continue despite of such actions under mutual consultation.

Table 15.4-1 Dissemination Project: Monitoring Results Summary

(Unit: P)

Motlhabaneng											
Category of User	Total Users	Payment Record (No. of Payers)									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
50Wp	23	9	21	21	20	20	20	20	19	19	19
100Wp	7	1	6	6	6	6	6	6	6	6	5
150Wp	1	0	1	1	1	0	0	0	0	0	0
200Wp	0	0	0	0	0	0	0	0	0	0	0
250Wp	3	1	2	2	3	3	3	3	3	3	3
Free Monthly Charge			1	1	1	2	1	1	1	1	1
SHS Total Users	34	11	31	31	31	31	30	30	29	29	28
This month Defaulters		0	3	3	3	3	4	4	5	5	6
Cummulative defaulters 3 months or more		0	0	0	3	0	0	0	1	1	2
Cummulative 2 months defaulters		0	0	3	0	0	0	1	0	1	0
Cummulative 1 month defaulters		0	3	0	0	0	1	0	1	0	1
Repossessed		0	0	0	0	3	3	3	3	3	3
50Wp		(0)	(0)	(0)	(0)	(2)	(2)	(2)	(2)	(2)	(2)
100Wp		(0)	(0)	(0)	(0)	(1)	(1)	(1)	(1)	(1)	(1)
150Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
200Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
250Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
SHS Revenue (100% Collection) (P)	19,800		2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200	2,200
SHS Revenue (100% Collection Exc. Repossessed) (P)	18,840		2,200	2,200	2,200	2,040	2,040	2,040	2,040	2,040	2,040
SHS Revenue (Actual) (P)	16,760		1,840	1,840	2,000	1,880	1,880	1,880	1,840	1,840	1,760
% of Revenue Collection	84.6%		83.6%	83.6%	90.9%	85.5%	85.5%	85.5%	83.6%	83.6%	80.0%
% of Revenue Collection (Exc. Repossessed)	89.0%		83.6%	83.6%	90.9%	92.2%	92.2%	92.2%	90.2%	90.2%	86.3%
% of Paid Users	88.2%		91.2%	91.2%	91.2%	91.2%	88.2%	88.2%	85.3%	85.3%	82.4%
% of Paid Users (Exc. Repossessed)	93.8%		91.2%	91.2%	91.2%	100.0%	96.8%	96.8%	93.5%	93.5%	90.3%

Kudumatse											
Category of User	Total Users	Payment Record (No. of Payers)									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
50Wp	30	30	30	29	28	29	28	28	27	27	26
100Wp	7	7	7	7	7	7	7	7	7	7	7
150Wp	2	2	2	2	2	2	2	2	2	2	2
200Wp	1	1	1	1	1	1	1	0	0	0	0
250Wp	0	0	0	0	0	0	0	0	0	0	0
Free Monthly Charge		0	0	1	1	0	1	1	2	1	1
SHS Total	40	40	40	40	39	39	39	38	38	37	36
This month Defaulters		0	0	0	1	1	1	2	2	3	4
Cumulative defaulters 3 months or more		0	0	0	0	0	1	0	0	1	0
Cumulative 2 months defaulters		0	0	0	0	1	0	0	1	0	1
Cumulative 1 month defaulters		0	0	0	1	0	0	1	0	1	1
Repossessed		0	0	0	0	0	0	1	1	1	2
50Wp		(0)	(0)	(0)	(0)	(0)	(0)	(1)	(1)	(1)	(1)
100Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
150Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
200Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)
250Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
SHS Revenue (100% Collection) (P)	19,440		2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160	2,160
SHS Revenue (100% Collection Exc. Repossessed) (P)	19,120		2,160	2,160	2,160	2,160	2,160	2,120	2,120	2,120	1,960
SHS Revenue (Actual) (P)	18,060		2,160	2,120	2,080	2,120	2,080	1,920	1,880	1,880	1,840
% of Revenue Collection	93.0%		100.0%	98.1%	96.3%	98.1%	96.3%	88.9%	87.0%	87.0%	85.2%
% of Revenue Collection (Exc. Repossessed)	94.6%		100.0%	98.1%	96.3%	98.1%	96.3%	90.6%	88.7%	88.7%	93.9%
% of Paid Users	96.1%		100.0%	100.0%	97.5%	97.5%	97.5%	95.0%	95.0%	92.5%	90.0%
% of Paid Users (Exc. Repossessed)	97.5%		100.0%	100.0%	97.5%	97.5%	97.5%	97.4%	97.4%	94.9%	94.7%

Lorolwana (SHS)												
Category of User	Total Users	Payment Record (No. of Payers)										
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
50Wp	35	9	28	30	28	28	29	27	27	26	24	
100Wp	4	3	3	3	3	3	3	3	3	3	3	
150Wp	1	0	0	1	1	1	0	1	1	0	1	
200Wp	0	0	0	0	0	0	0	0	0	0	0	
250Wp	0	0	0	0	0	0	0	0	0	0	0	
Free Monthly Charge			5	2	3	2	2	0	0	1	0	
SHS Total	40	12	36	36	35	34	34	31	31	30	28	
This month Defaulters		0	4	4	5	10	10	14	15	16	18	
Cummulative defaulters 3 months or more		0	0	0	4	0	1	1	0	3	3	
Cummulative 2 months defaulters		0	0	4	0	1	1	0	3	0	1	
Cummulative 1 month defaulters		0	4	0	1	1	0	3	0	1	2	
Repossessed		0	0	0	0	4	4	5	6	6	6	
50Wp		(0)	(0)	(0)	(0)	(3)	(3)	(4)	(5)	(5)	(5)	
100Wp		(0)	(0)	(0)	(0)	(1)	(1)	(1)	(1)	(1)	(1)	
150Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
200Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
250Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
SHS Revenue (100% Collection) (P)	16,560		1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	
SHS Revenue (100% Collection Exc. Repossessed) (P)	15,080		1,840	1,840	1,840	1,640	1,640	1,600	1,560	1,560	1,560	
SHS Revenue (Actual) (P)	12,760		1,360	1,560	1,480	1,480	1,400	1,440	1,440	1,280	1,320	
% of Revenue Collection	77.1%		73.9%	84.8%	80.4%	80.4%	76.1%	78.3%	78.3%	69.6%	71.7%	
% of Revenue Collection (Exc. Repossessed)	84.6%		73.9%	84.8%	80.4%	90.2%	85.4%	90.0%	92.3%	82.1%	84.6%	
% of Paid Users	81.9%		90.0%	90.0%	87.5%	85.0%	85.0%	77.5%	77.5%	75.0%	70.0%	
% of Paid Users (Exc. Repossessed)	89.7%		90.0%	90.0%	87.5%	94.4%	94.4%	88.6%	91.2%	88.2%	82.4%	

Grand Total											
Category of User	Total Users	Payment Record (No. of Payers)									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
50Wp	88	48	79	80	76	77	77	75	73	72	69
100Wp	18	11	16	16	16	16	16	16	16	16	15
150Wp	4	2	3	4	4	3	2	3	3	2	3
200Wp	1	1	1	1	1	1	1	0	0	0	0
250Wp	3	1	2	2	3	3	3	3	3	3	3
Free Monthly Charge	0	0	6	4	5	4	4	2	3	3	2
SHS Total Users	114	63	107	107	105	104	103	99	98	96	92
This month Defaulters		0	7	7	9	14	15	20	22	24	28
Cummulative defaulters 3 months or more		0	0	0	7	0	2	1	1	5	5
Cummulative 2 months defaulters		0	0	7	0	2	1	1	4	1	2
Cummulative 1 month defaulters		0	7	0	2	1	1	4	1	2	4
Repossessed		0	0	0	0	7	7	9	10	10	11
50Wp		(0)	(0)	(0)	(0)	(5)	(5)	(7)	(8)	(8)	(8)
100Wp		(0)	(0)	(0)	(0)	(2)	(2)	(2)	(2)	(2)	(2)
150Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
200Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)
250Wp		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
SHS Revenue (100% Collection) (P)	55,800	0	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
SHS Revenue (100% Collection Exc. Repossessed) (P)	53,040	0	6,200	6,200	6,200	5,840	5,840	5,760	5,720	5,720	5,560
SHS Revenue (Actual) (P)	47,600	0	5,360	5,520	5,560	5,480	5,360	5,240	5,160	5,000	4,920
% of Revenue Collection	85.3%		86.5%	89.0%	89.7%	88.4%	86.5%	84.5%	83.2%	80.6%	79.4%
% of Revenue Collection (Exc. Repossessed)	89.7%		86.5%	89.0%	89.7%	93.8%	91.8%	91.0%	90.2%	87.4%	88.5%
% of Paid Users	88.8%		93.9%	93.9%	92.1%	91.2%	90.4%	86.8%	86.0%	84.2%	80.7%
% of Paid Users (Exc. Repossessed)	93.7%		93.9%	93.9%	92.1%	97.2%	96.3%	94.3%	94.2%	92.3%	89.3%

Lorohwana (BCS)											
Category of User	Total Users	Payment Record (No. of Payers)									
		Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
No. of BCS Users (Registered)	41	41	41	41	41	41	41	41	41	41	41
NO. of BCS Users (actually charged)		13	22	16	16	20	17	23	25	33	30
NO. of BCS Users (not used)		28	19	25	25	21	24	18	16	8	11
No. of BCS Users who paid Fixed Charge		12	23	16	18	19	17	24	27	8	11
Charging Frequency		30	92	77	68	73	85	111	81	91	85
BCS Revenue based on Registered Users (P)	6150	615	615	615	615	615	615	615	615	615	615
BCS Actual Revenue (P)	2,422	180	345	240	270	285	255	360	216	131	140
% of BCS Revenue Collection	39.4%	29.3%	56.1%	39.0%	43.9%	46.3%	41.5%	58.5%	35.1%	21.3%	22.8%
BCS Revenue based on Net Users (34 people) (P)	5100	510	510	510	510	510	510	510	510	510	510
BCS Actual Revenue (P)	2,422	180	345	240	270	285	255	360	216	131	140
% of BCS Revenue Collection	47.5%	35.3%	67.6%	47.1%	52.9%	55.9%	50.0%	70.6%	42.4%	25.7%	27.5%
Tariff System: Fixed Charge only P15/month								Fixed Charge: P5/month			
								Demand Charge: 1P/charge			