

13.2 Financial Analysis

13.2.1 Basic Assumptions for Financial Analysis

① Currency and foreign exchange rate

All costs, expenses and prices in this financial analysis are indicated in local currency (Pula), and the following foreign exchange rate is applied:

$$\text{US1\$} = \text{P6.5}$$

② Escalation

All costs, expenses and prices in this financial analysis are fixed as of the fourth quarter of 2001, with no escalation being considered thereafter.

③ Depreciation and amortization

Depreciation and amortization, where applicable in this financial analysis, are carried out under the following rules:

Depreciation of tangible fixed assets

- Depreciation method: Straight-line method
- Residual value: Zero
- Depreciation period: Building – 25 years
PV system – 20 years
Battery – 3 years

④ Corporate income tax

The corporate income tax rate in the country is 15%. However, Botswana Power Company (BPC) is exempted from it as a public utility, while BPC paid a dividend of about 8 million pula to the Government last year. The project is also assumed to be tax exempted on strength of its objective to promote rural electrification.

⑤ Fixed assets

In this case study, financial evaluation is made for expenditures related to fixed assets, deducting subsidies to the initial investment (a fixed asset after a reduced value entry is counted)

⑥ Pre-operation expenses

Pre-operation expenses are not included in this financial evaluation.

⑦ Evaluation of profitability

Profitability of the project is evaluated on the basis of a financial internal rate of return (FIRR) obtained from the financial analysis. As the prime rate in Botswana is 15%, as discussed in Chapter 11, the target ROI should exceed 15%. The conditions under which the ROI of 18% - 20% can be achieved are assumed to be the Base-case.

⑧ Evaluation period

The master plan assumes the project period of ten years, while the financial evaluation period is twenty years between 2003 and 2012, with the year 2002 as the preparation period.

13.2.2 Case Study

Financial analyses for the following cases are carried out to obtain the amount of subsidy required to achieve the target ROI. Sensitive analysis is carried out as well.

(1) Base Case

The case to use both SHS and BCS and achieve the ROI of 18% - 20% is assumed to be the Base Case. Then, the BCS electrification rates of 20% (A-1) and 30% (A-2) are analyzed. In addition, the case to achieve the ROI of 18% - 20% with the SHS only is assumed to be the Base Case B.

(2) Other Cases

Various cases with the following variants are set up, PV electrification rate, Subsidy ratio for equipment investment for the first 12 years, Monthly charge, PV demand by size, Facility cost and costs of Implementation Body.

Table 13.2-1 Case Study (1/2)

	Demand by PV size	PV electrification rate		User charge				Equipment cost	
		SHS	BCS	Total Collection Rate					
				100%	95%	90%	85%		
Base Case A, B	Results of Dissemination Project 50Wp : 77.1% 100Wp : 15.8% 150Wp : 3.5% 200Wp : 0.9% 250Wp : 2.6% 350Wp : 0%	40%	0%, 20%及び30%	Standard Tariff				Standard Cost	
Case 11 A, B		30%	0%, 20%及び30%						
12 A, B		50%	0%, 20%及び30%						
13 A, B		60%	0%, 20%及び30%						
20 A-(2), B		SHS/BCS: 40%/0% 40%/20% 40%/30%							80% of Standard Tariff
20 A, B				90% of Standard Tariff					
21 A, B				110% of Standard Tariff					
22 A, B				120% of Standard Tariff					
30 A, B				Standard Tariff		80% of Standard Cost			
31 A, B		90% of Standard Cost							
32 A, B		110% of Standard Cost							
40 A, B		Results of socioeconomic surveys 50Wp : 50% 100Wp : 22% 150Wp : 8.1% 200Wp : 0.9% 250Wp : 5.7% 350Wp : 13.3%							Standard Cost

Case Study (2/2) (Variation of Subsidy Ratio)

	Subsidy ratio for equipment investment in the first 12 years
For each of cases in Table13.2-1	65%
	70%
	75%
	80%

(3) Electrification rate and PV electrified households

Figure 13.2-1 shows the changes in the total electrification rate (the percentage of SHS/BCS electrified households of the total number of households in the target villages and localities) with the variation of the electrification rate of the target villages and localities assumed in the cases.

As the BCS is assumed to be installed with the SHS in villages and localities with more than 500 residents, the total electrification rate varies as follows.

BCS electrification rate	Total electrification rate
20%	SHS electrification rate + 7.3%
30%	SHS electrification rate + 10.9%

Figure 13.2-2 shows the changes in the number of PV electrified households with variation of the SHS and BCS electrification rates.

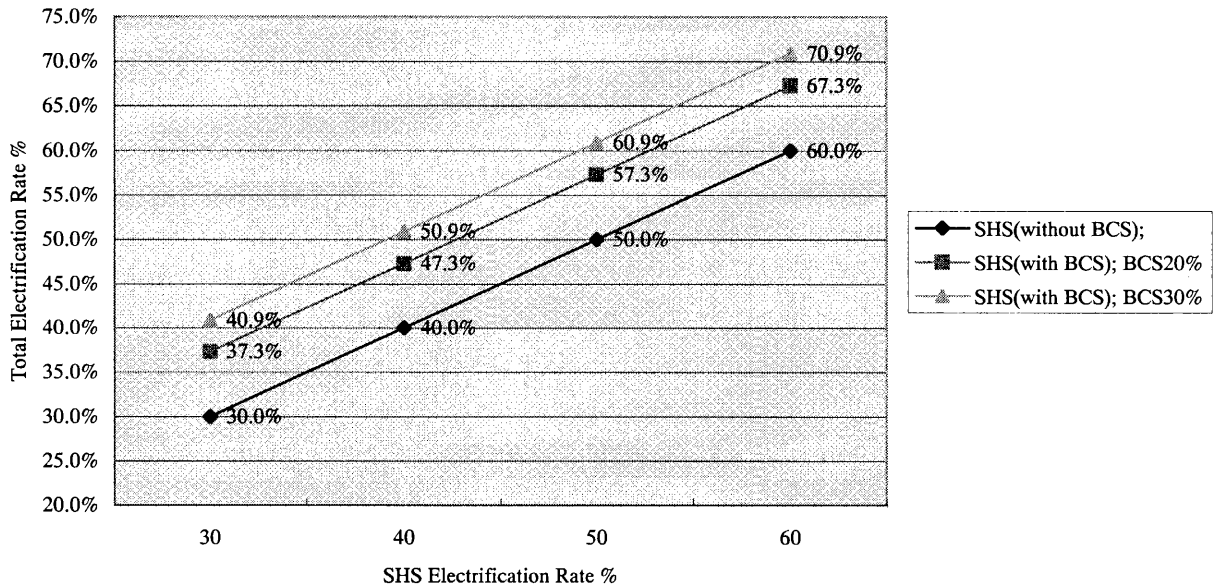


Figure 13.2-1 Total Electrification Rate per BCS Electrification

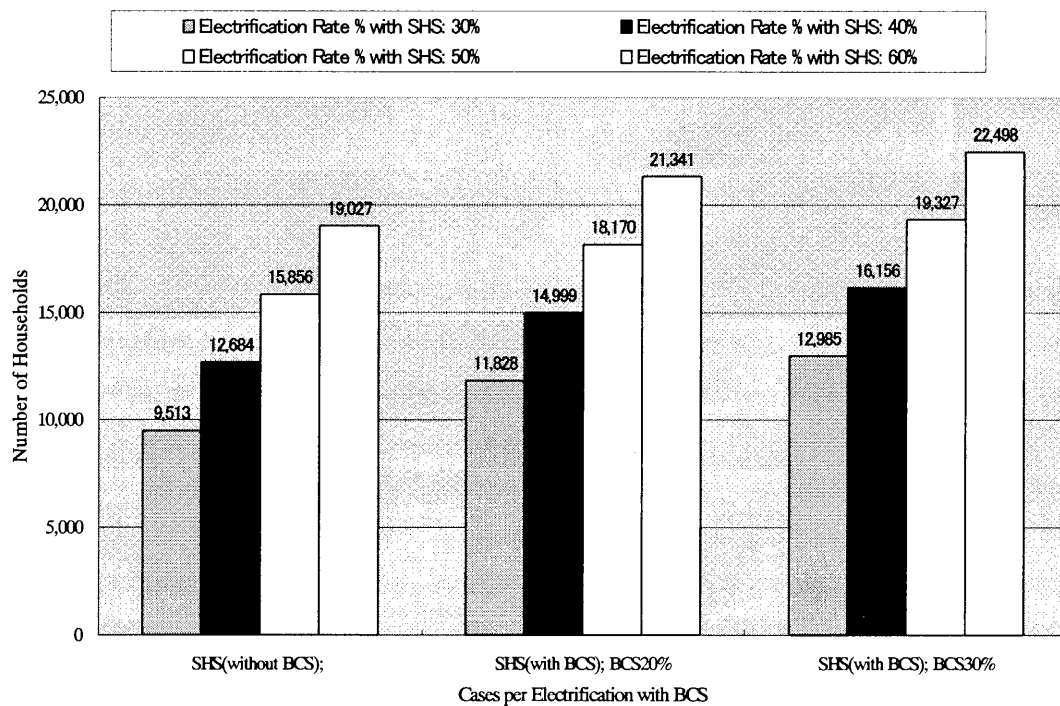


Figure 13.2-2 Total Number of Households Electrified

(4) Installed PV capacity

The breakdown of the installed PV capacity (kWp) for various cases, by SHS, BCS and public facilities, is shown in Figure 13-2-3. Clearly, the PV capacity for public facilities accounts for significant portions.

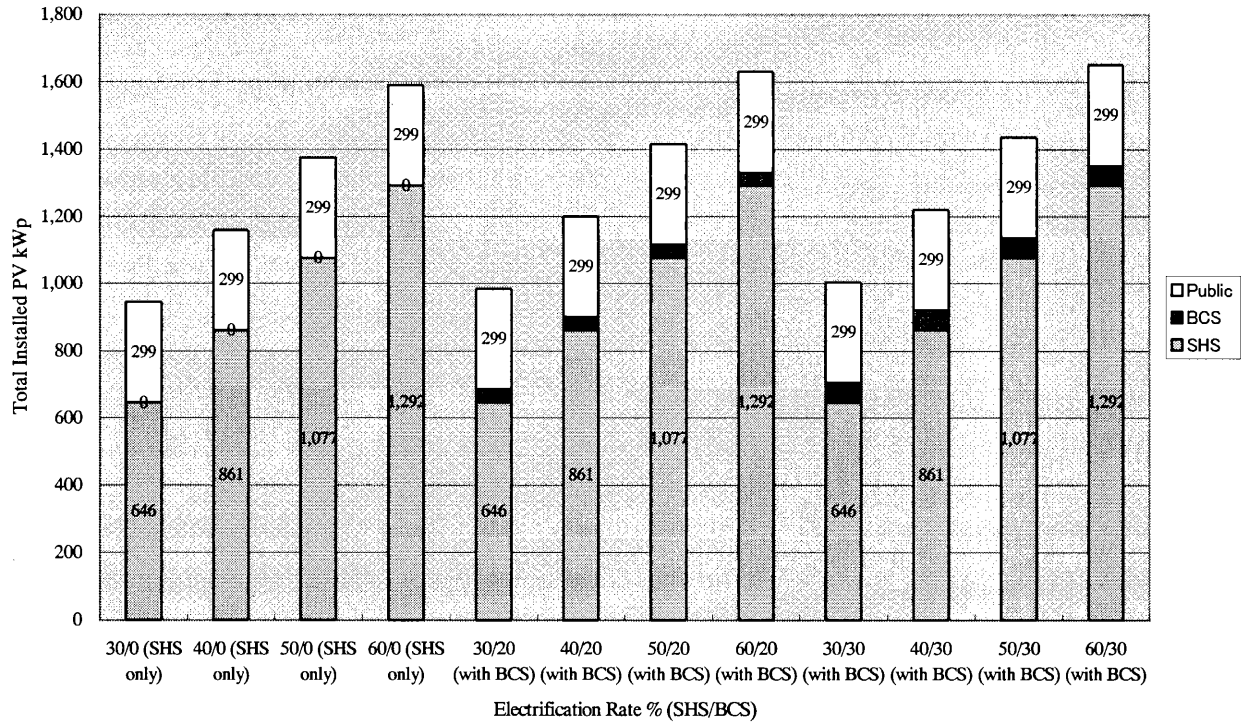


Figure 13.2-3 Total Installed PV Capacity

13.2.3 Financial Analysis

The results of financial analysis reveal that the Internal Rate of Return on Investment (IRROI) of 18% - 20% for Base Case A or B can only be achieved with the following subsidy ratios. The following table summarizes the effect on project feasibility under the various cases. Tariff collection rate are assumed as 90% from the results of Dissemination Project.

Table 13.2-2 Case Study of Electrification Rate

(Unit: kP)

	Case	Base Case A-1	Base Case A-2	Base Case B
	Electrification rate % : SHS/BCS	40/20	40/30	40/0
1	Total investment in the project life (20 years)	185,623	192,867	167,950
2	Tariff Rate : P/m/50Wp / BCS	40/15	40/15	40/15
	Tariff Collection Rate: %	90%	90%	90%
3	Subsidy for operating cost in the first 10 years (% for Tariff revenue)	0%	0%	0%
	Subsidy for operating cost in the first 10 years	0	0	0
4	Subsidy Ratio for capital investment in the subsidy allocation period	80%	80%	80%
	Subsidy Allocation Period	12	12	12
	Subsidy for capital investment in the first 10 years	101,504	105,475	91,014
	Subsidy for capital investment in the subsidy allocation period	111,522	115,704	100,611
	Subsidy ratio for total investment	60.1%	60.0%	59.9%
5	Total subsidy in the first 10 years	101,504	105,475	91,014
6	Capital	28,442	29,520	25,650
	Capital increase to attain positive cash flow	1,766	1,675	20
7	Internal Rate of Return on Investment (IRROI)	18.0%	17.6%	19.8%
8	Cash generated in the 20 years (excluding the residual value)	62,404	62,422	62,366
9	No. of households/total PV electrification rate	14,999 (47.3%)	16,156 (50.9%)	12,684 (40.0%)
10	Total installed PV capacity (kWp)	1,200	1,220	1,160

(1) Government subsidy and funding requirements for the Implementation Body

1) Effect of subsidy ratio

Government subsidy is designed to cover a certain percentage of the investment cost required for the first 12 years after the start of project operation (including renewal costs of batteries) for the purpose of ensuring that the project is operated on a sustainable basis. Figures 13.2-4 and 13.2-5 show the changes in IRROI when the subsidy ratio is varied with the internal fund of 20% and the remaining fund requirement is met by loans.

Note that “E/S/L” in the figures represent “equity/subsidy/loan.” As clearly seen from these figures, the subsidy ratio has significant impacts on the IRROI. To achieve the target IRROI of 18% - 20%, government subsidy should cover the entire financial requirements other than the working capital (20%) for the first 12 years. On the other hand, variation of the electrification rate has relatively small impacts on the IRROI.

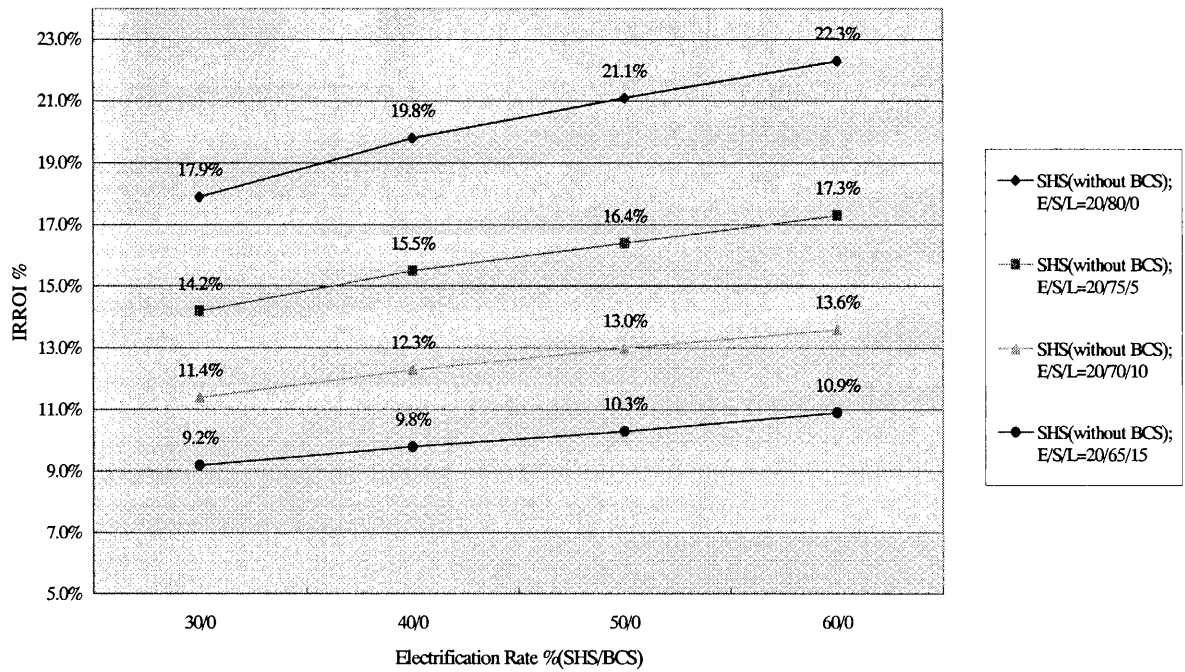


Figure 13.2-4 Sensitive Analysis on Subsidy Ratio (Case of SHS only)

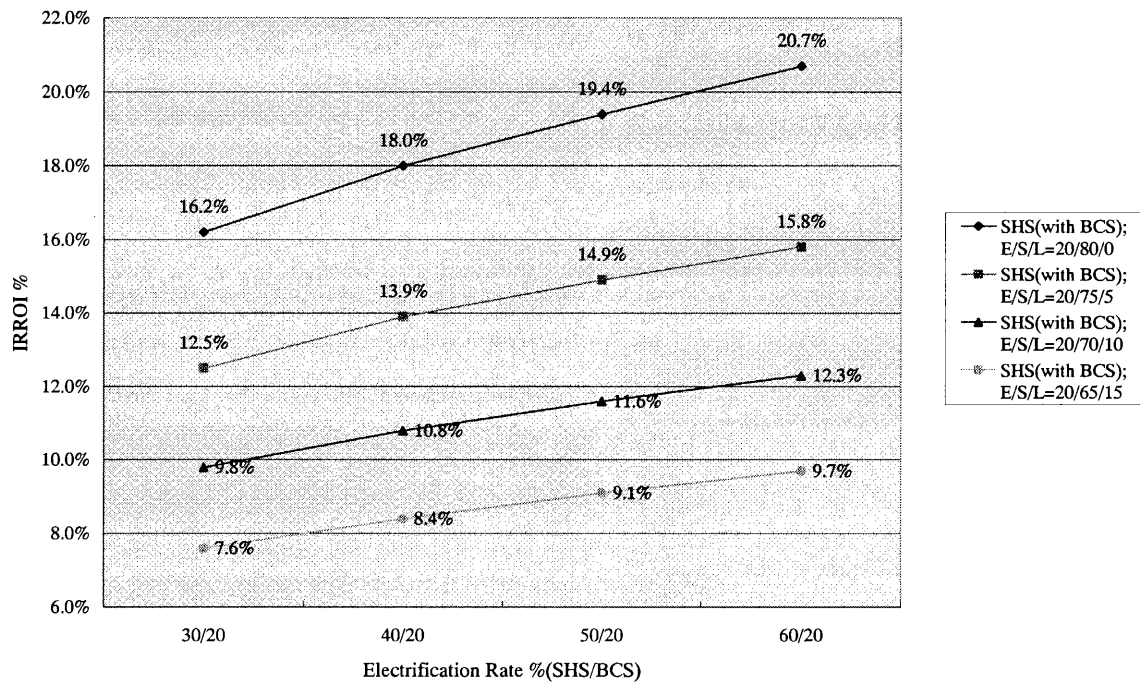


Figure 13.2-5 Sensitivity Analysis on Subsidy Ratio (with the BCS Electrification Rate of 20%)

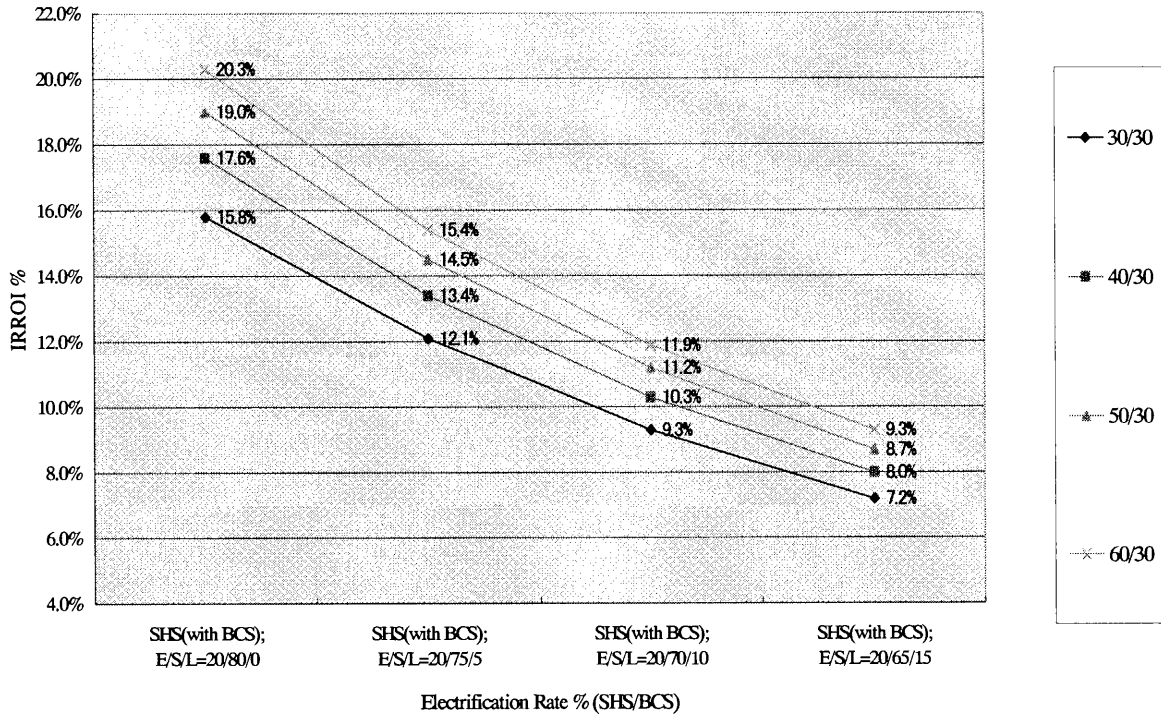


Figure 13.2-6 Sensitivity Analysis on Subsidy Ratio (with the BCS Electrification Rate of 30%)

2) Total subsidy requirements

For Base Case A (BCS/SHS; SHS electrification rate of 40%; BCS electrification rate of 20%/30%) and Base Case B (SHS electrification rate of 40%), the amount of subsidy required to achieve the IRROI of about 18% was calculated and shown in Figure 13.2-7, together with the total investment cost.

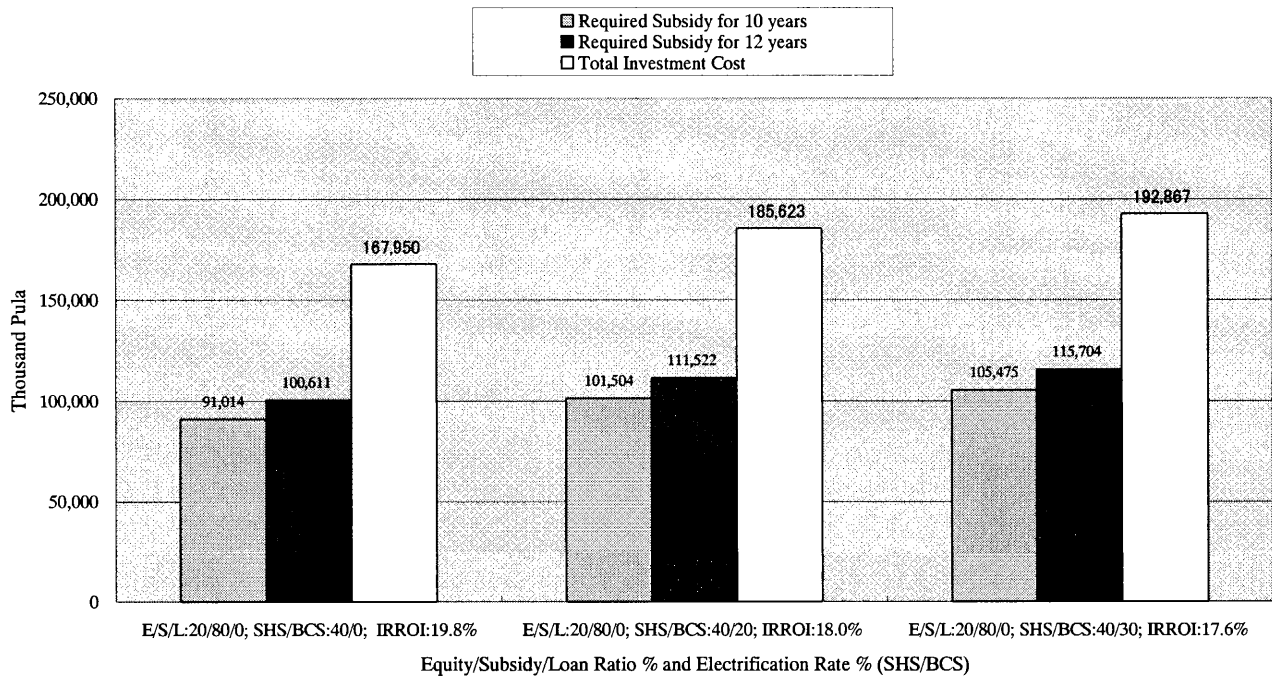


Figure 13.2-7 Required Subsidy for Project Life

Figure 13.2-8 shows the changes in the amount of subsidy over 12 years for Base Case A-1 (BCS/SHS; SHS electrification rate of 40%; BCS electrification rate of 20%; equity ratio of 20%/subsidy ratio of 80%).

(Electrification Rate % SHS/BCS:40/20, Equity/Subsidy/Loan:20/80/0)

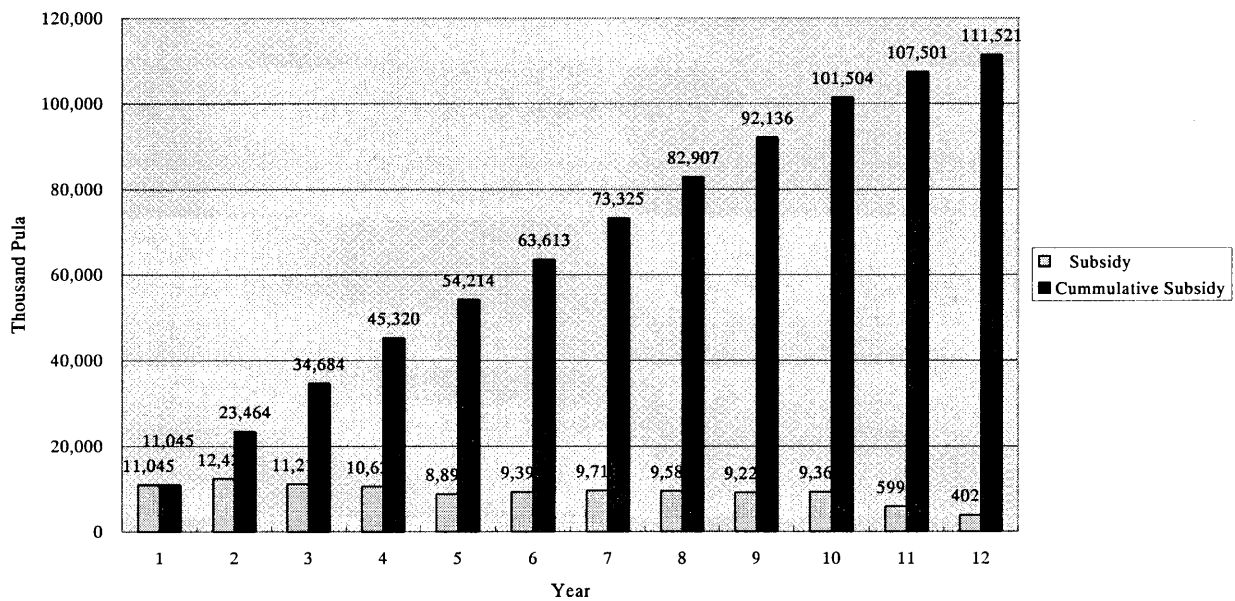


Figure 13.2-8 Change in Subsidy for 12 Years