3) Self-financed funds

The relationship between self-financed funds (equity, capital increase, loan) and net profit for Base Case A-1 (SHS/BCS electrification rate of 40%/20%; subsidy ratio of 80%) is shown in Figure 13.2-9.

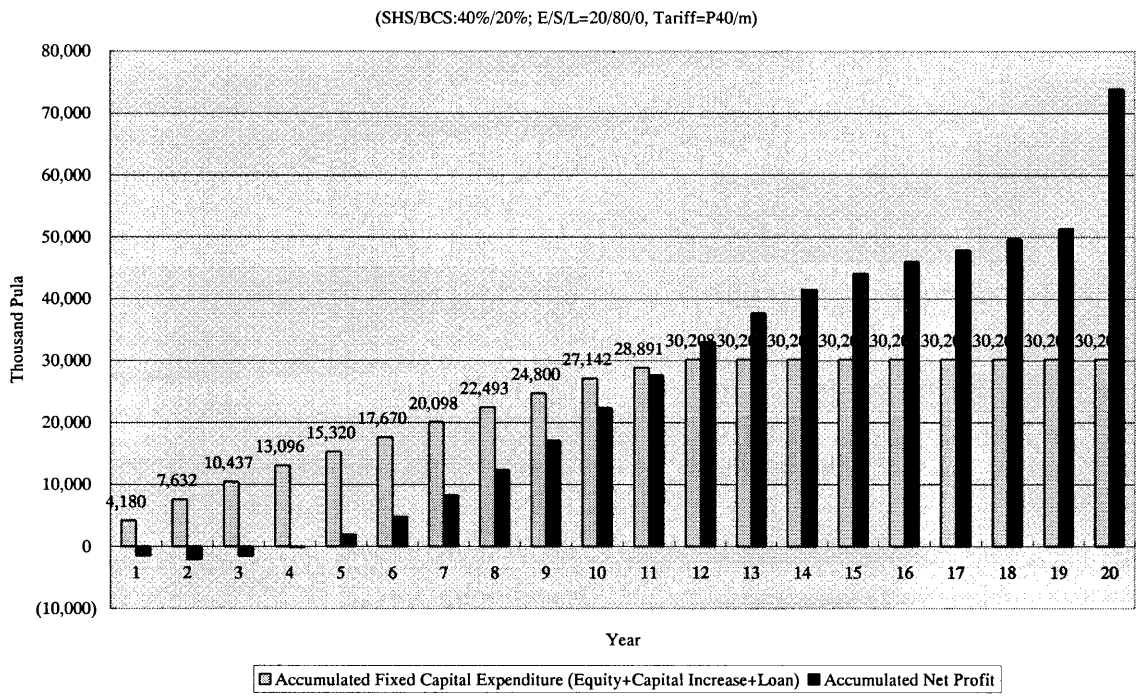

Figure 13.2-9 Accumulated (Equity + Capital Increase + Long Term Loan) and Net Profit

(2) Effect of tariff rate change

Figure 13.2-10 shows the change in the IRROI with variation of the user charge per 50Wp. Clearly, the user charge has considerable impacts on project profitability. Figure 13.2-11 shows the change in the IRROI with variation of the tariff collection rate. Baseline is supposed as 90% collection rate based on the results in Dissemination Project. Collection rate is highly sensitive on IRROI. Thus, keeping a high collection rate is critical to sound profitability.

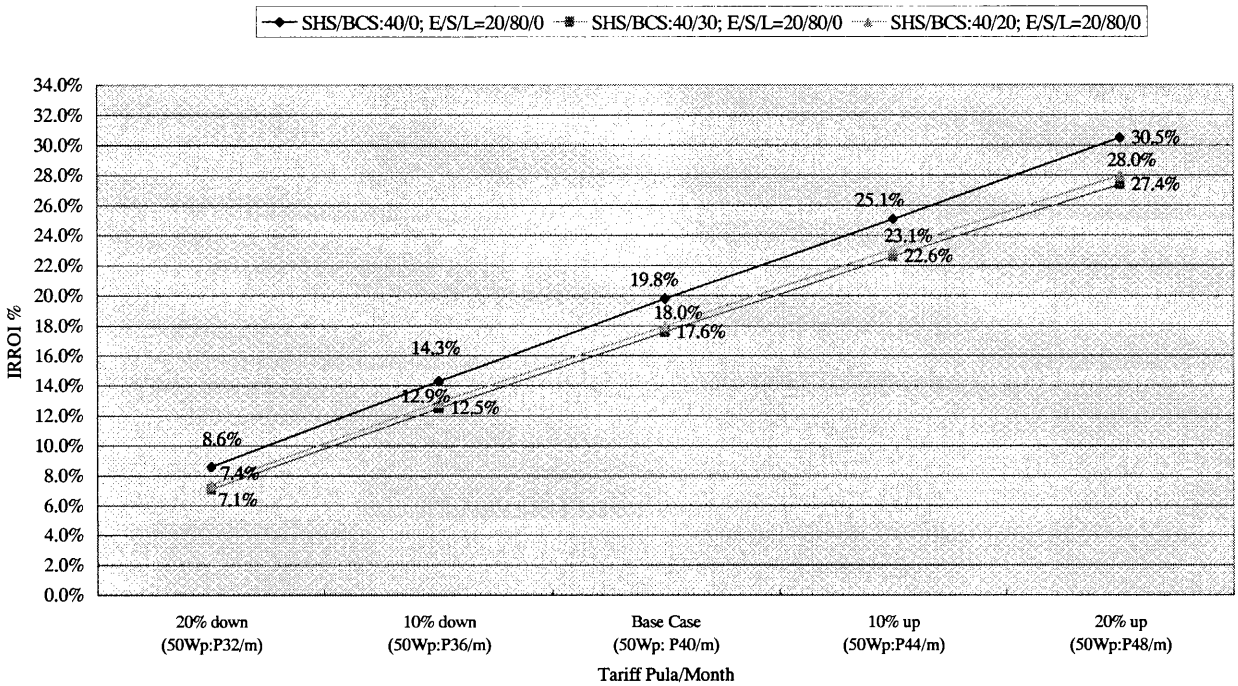

Figure 13.2-10 Sensitivity Analysis on Tariff Level

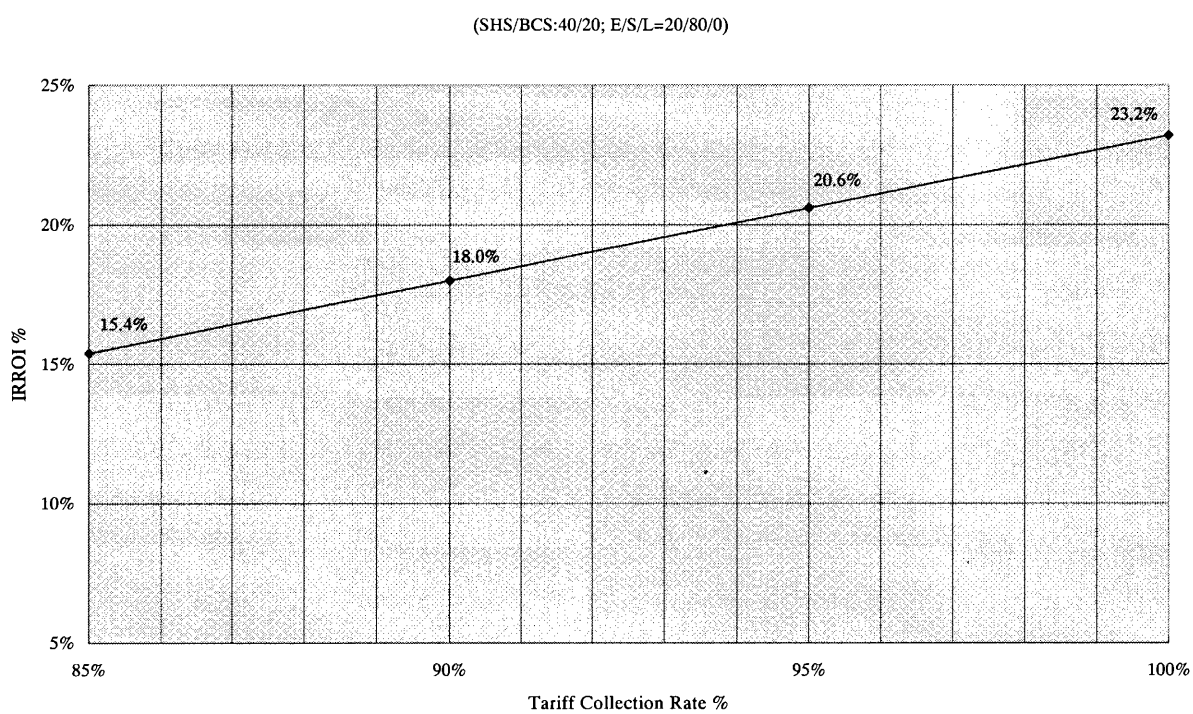

Figure 13.2-11 Sensitivity Analysis on Tariff Collection Level

Figure 13.2-12 compares the amount of cash generated over 20 years with variation of tariff levels.

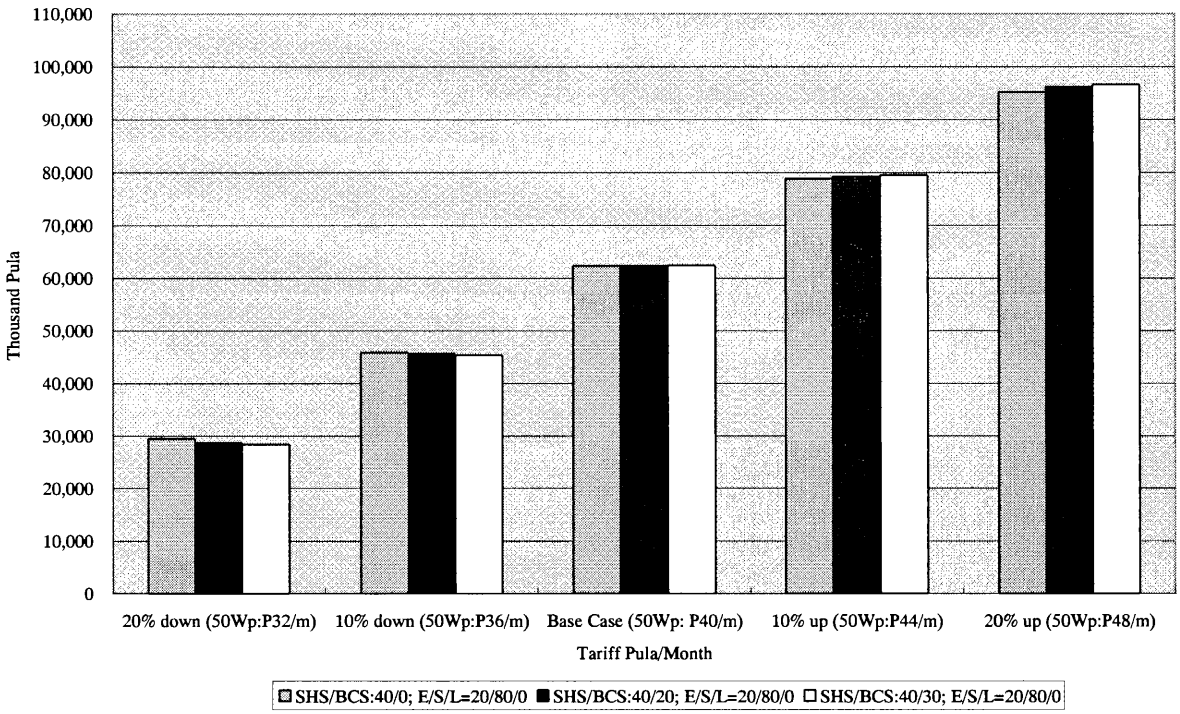

Figure 13.2-12 Cash Generation per Tariff Variation

(3) Effect of variation of village-based electricity demand forecast on project profitability

1) Electricity demand forecast per household

The results of the socioeconomic surveys of villages conducted during the present study indicate that the average electricity demand per household is 122Wp.

On the other hand, actual demand obtained in the Dissemination Project is much lower than the figure estimated from the survey results, and the project plan adopts the average demand of 68Wp. Figure 13.2-13 shows the total installed PV capacity for the SHS electrification rate of 40%. Note that the project plan assumes 1,160kWp for the SHS electrification, compared 1,843kWp estimated from the survey results. Similarly, for the SHS/BCS electrification (BCS 20%), the project plan uses 1,200kWp vs. 1,883kWp.

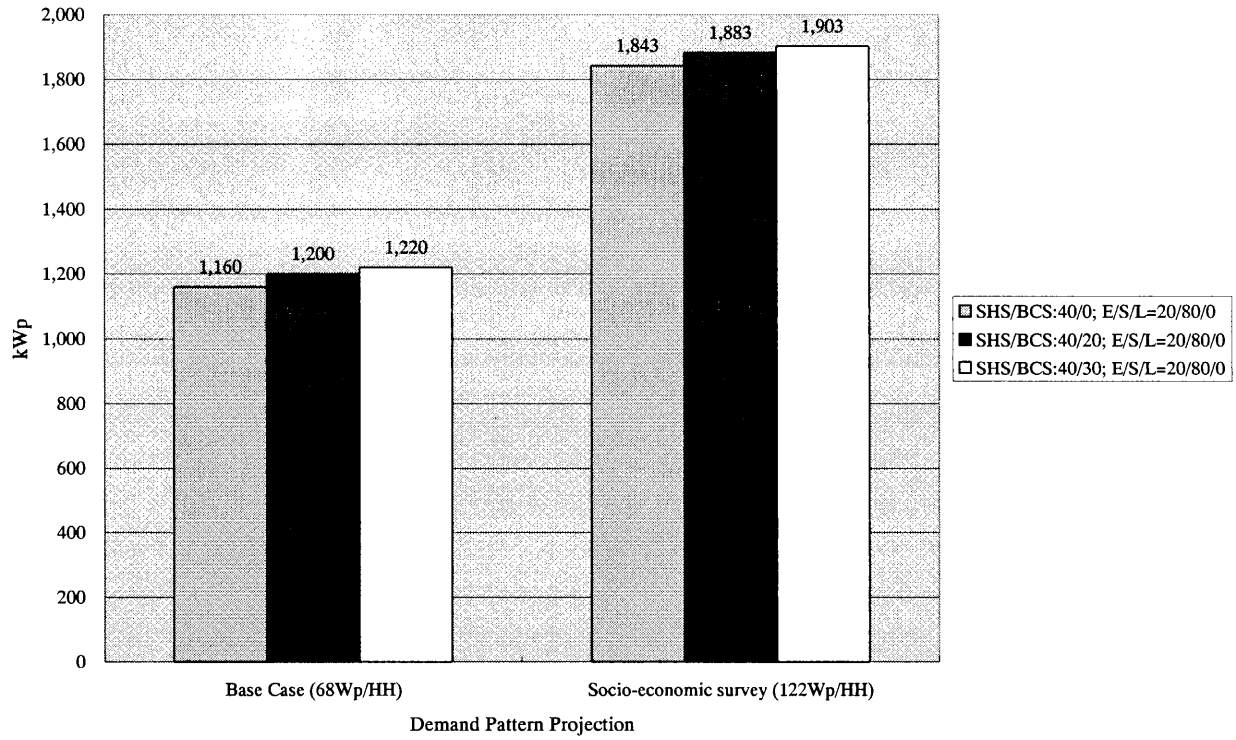

Figure 13.2-13 Total Installed PV Capacity per Demand Pattern Projection

Figure 13.2-14 shows the effect of demand variation on project profitability. For the SHS electrification, the IRROI is 19.8% for the demand estimated under the project plan and 25.9% for the demand based on the socio economic survey results, a difference of 6.1 percentage points. For the SHS/BCS installation (BCS 20%), the IRROI is 18.0% vs. 24.1%, respectively and the difference of 6.1 percentage points.

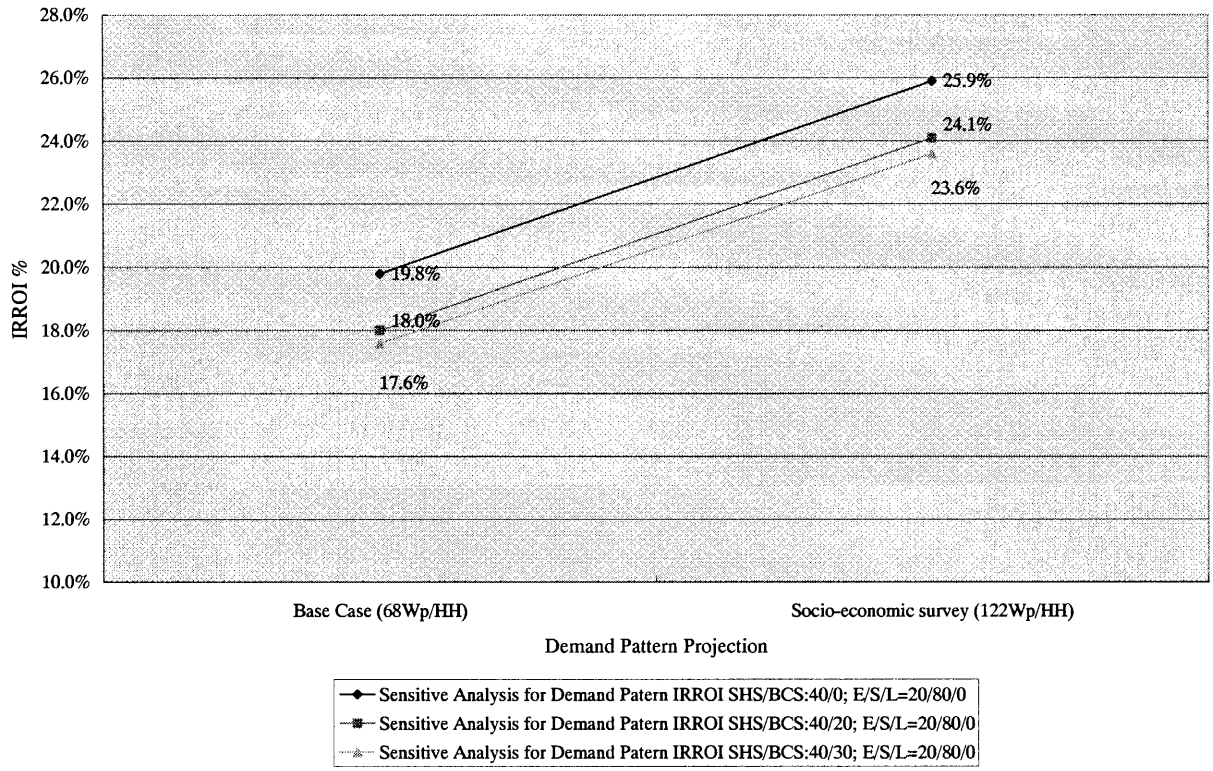

Figure 13.2-14 Sensitive Analysis per Demand Pattern Projection

2) Electricity demand for public facilities

The project plan assumes electricity demand for public facilities at 1,650Wp per village (350Wp per locality) on the basis of the results of the socioeconomic surveys. Then the user charge is assumed to be 50% higher than that for general households, P60 per month. Figure 13.2-15 shows the changes in the installed capacity mix (SHS, BCS, public facilities) by varying the electrification rate. It reveals that, when the household electrification rate becomes lower, weight of public facilities increases.

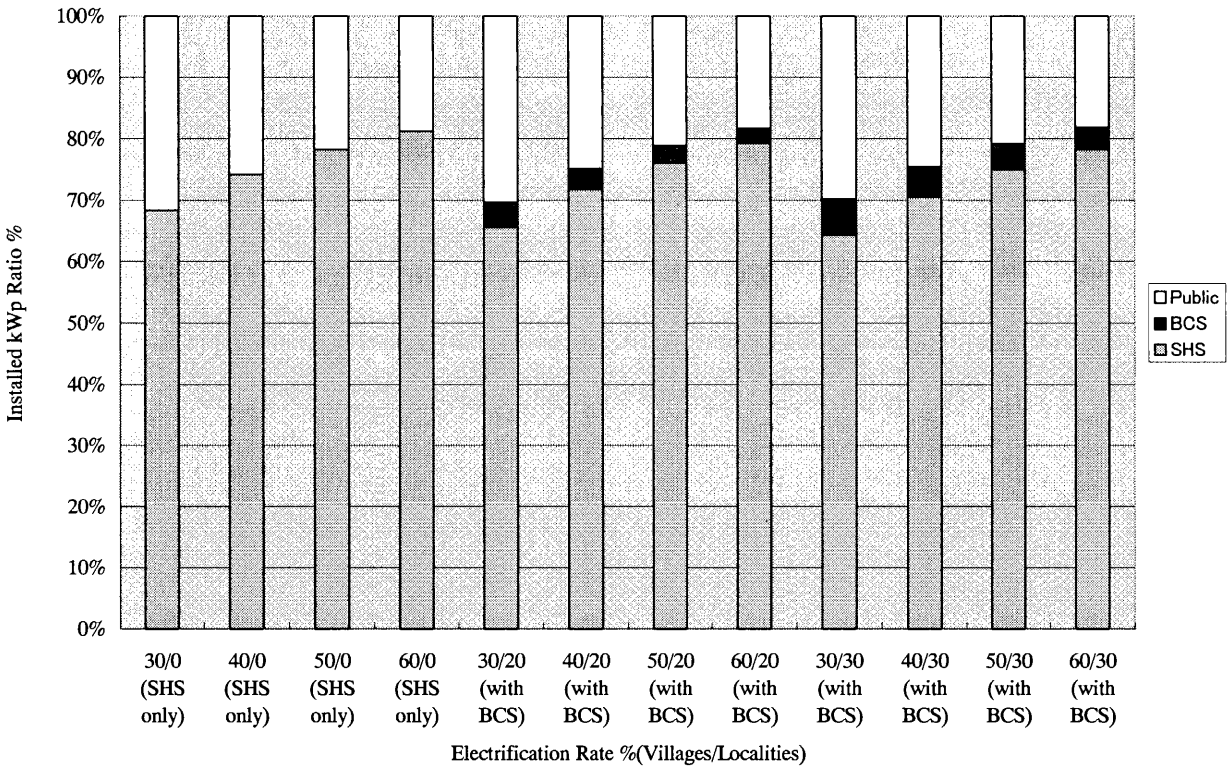

Figure 13.2-15 Installed Capacity Ratio

Figure 13.2-16 shows the changes in the IRROI when demand for public facilities accounts for 60% of the above mentioned assumption, 1,650 Wp and 350Wp, (assuming the SHS electrification rate of 40%), for which the IRROI is 13.2%, down 4.8 percentage points from 18.0% for the SHS/BCS electrification (BCS 20%).

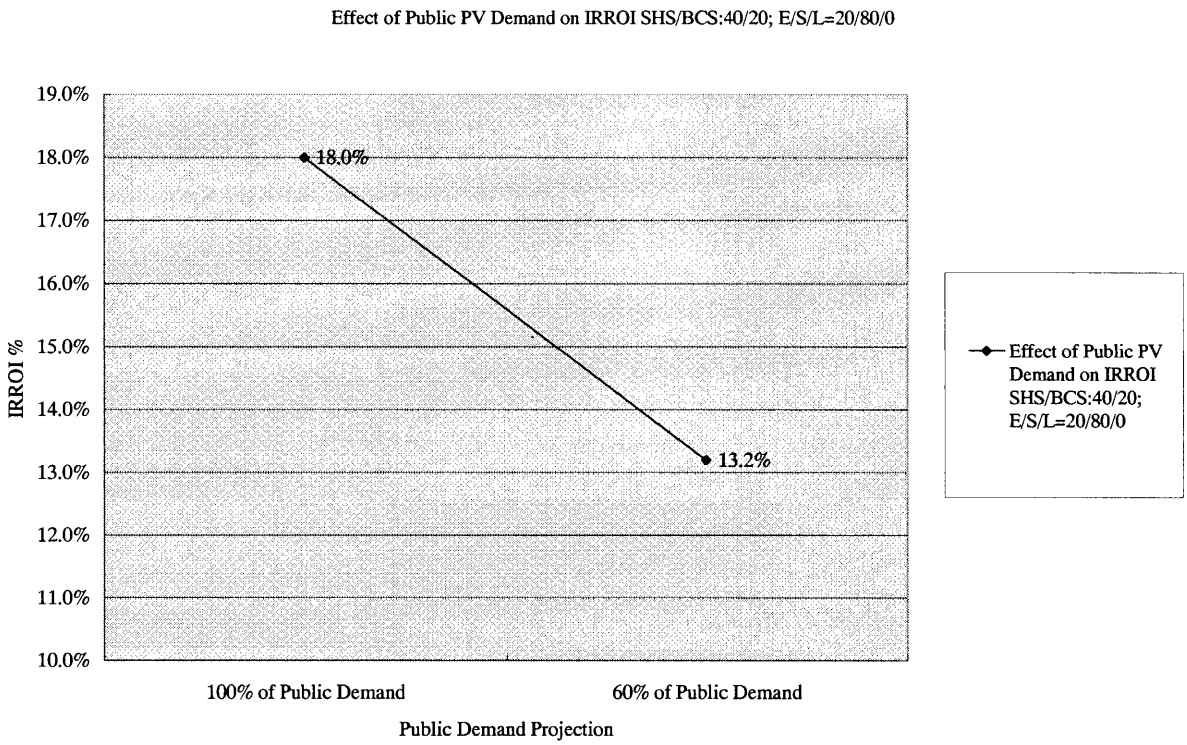

Figure 13.2-16 Effect of Public Demand on IRROI

Clearly, inclusion of public facilities in the project is very important. At present, each district installs and operates the PV system, which seems to require a much higher cost – a few times more than the cost estimated in the plan. Thus, integration of public facilities into the project is beneficial for both the Implementation Body and Districts.

(4) Sensitivity analysis on equipment investment

Figures 13.2-17 and Figure 13.2-18 show the results of sensitivity analysis on the total investment cost during the project period (20 years) by varying the household electrification rate. The total investment cost is divided into key portions, namely SHS, BCS, PV system for public facilities, and battery and controller (replacement).

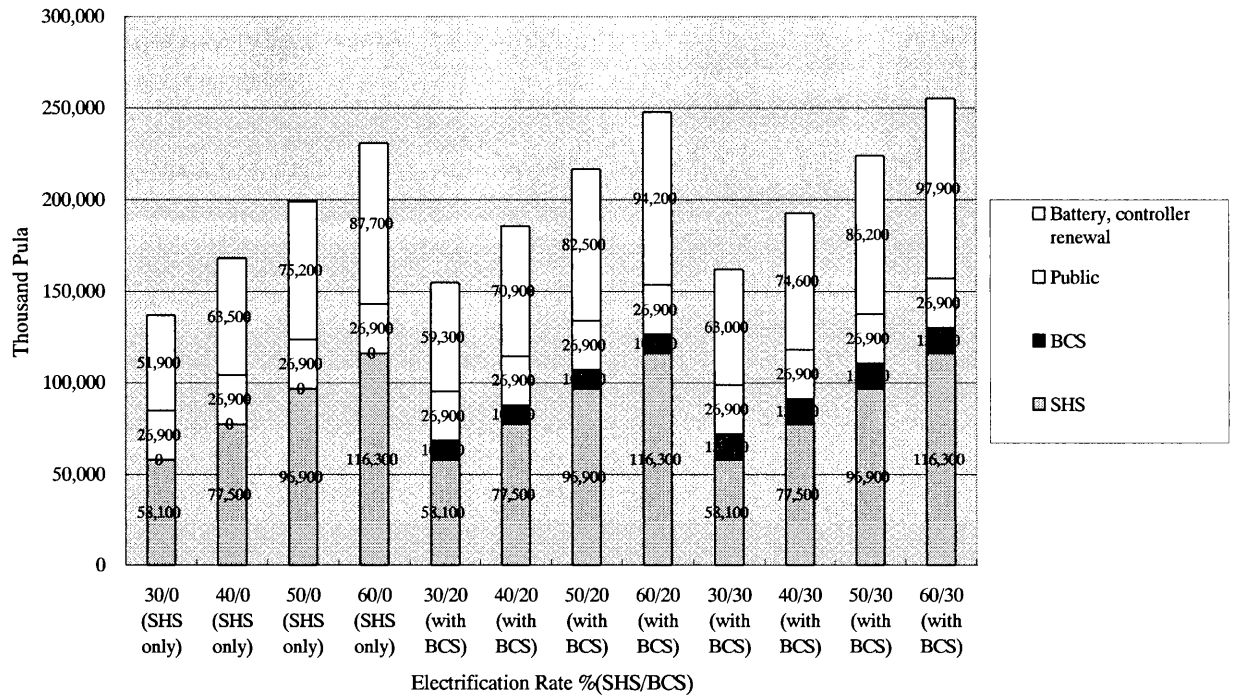

Figure 13.2-17 Total Investment Cost Breakdown for 20 Years

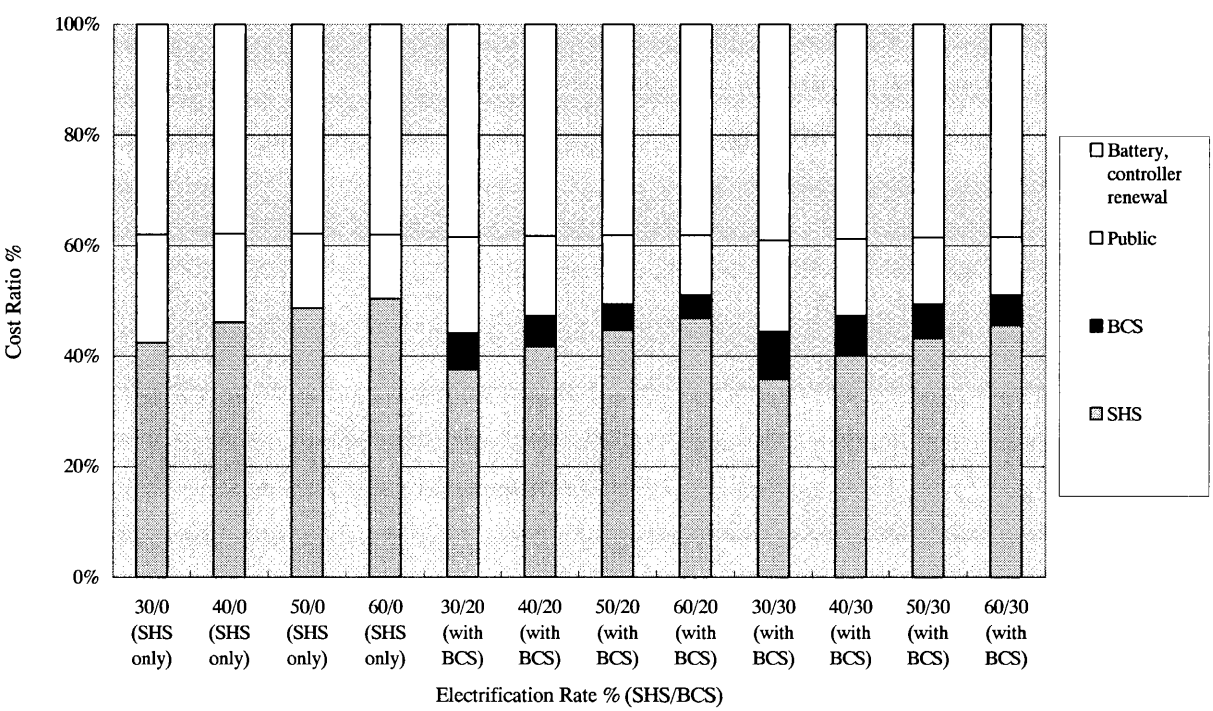

Figure 13.2-18 Investment Cost Breakdown Ratio

Figure 13.2-19 shows the effect of variation of the total investment cost, i.e., 10% decrease, 20% decrease or 10% increase, on the IRROI for the SHS electrification rate of 40%.

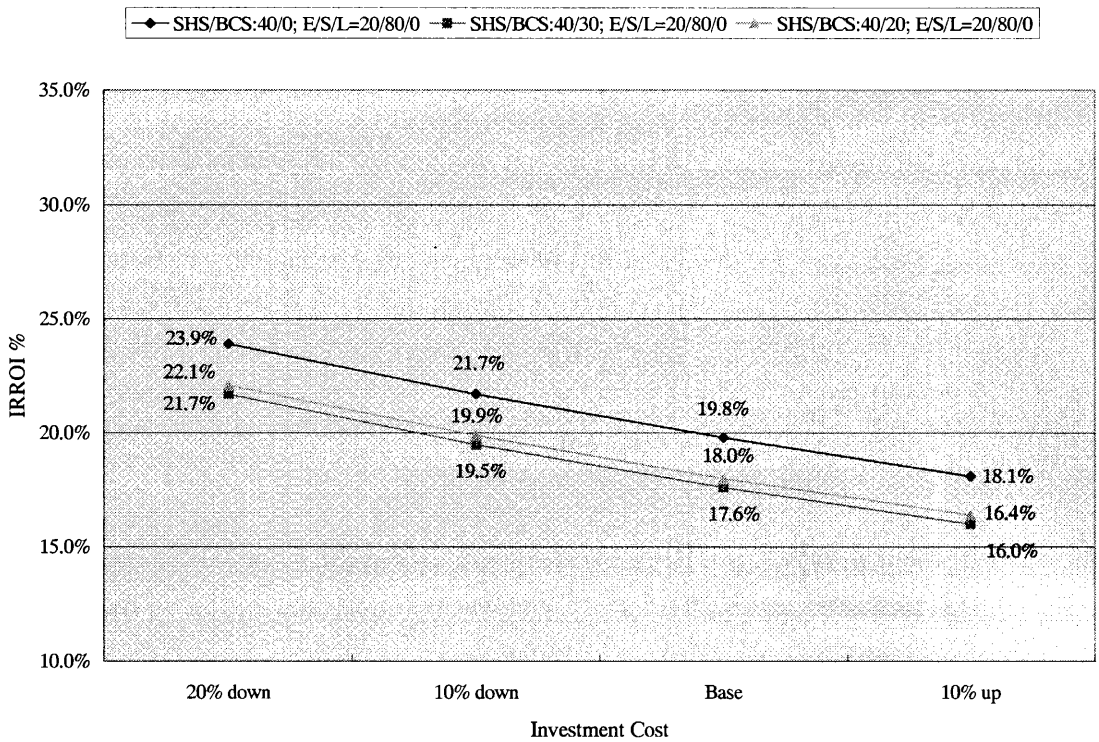

Figure 13.2-19 Sensitive Analysis for Investment Cost: IRROI

The 10% decrease in the investment cost causes the IRROI to improve approximately 1.9% for the SHS/BCS (40%/20%) electrification.

(5) Sensitivity analysis on operating cost

The present study recommends that, to ensure sustainable management of the project, activities related to system operation be conducted by local community organizations, as far as possible. Now, the operating cost incurred by the Implementation Body accounts for large portions and its reduction is expected to have significant impacts on project profitability. As shown in Figure 13.2-20, the IRROI improves more than 4.3 percentage points when the 20% cost reduction is achieved.

In case System Monitor's cost is reduced by 50%, the IRROI improve 3.8 percent that is less than that attained by BPC cost 20% cut.

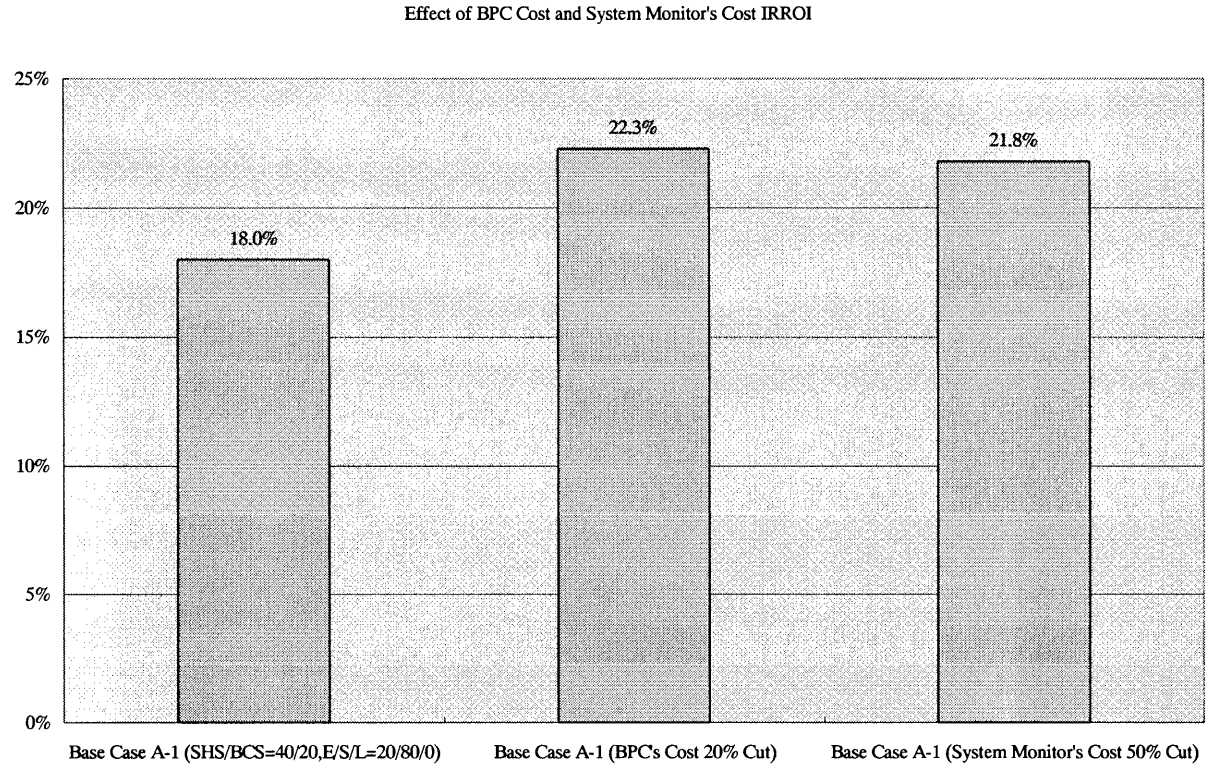

Figure 13.2-20 Effect of BPC and System Monitor's Costs on IRROI

(6) Need for improvement of BCS profitability

1) Equipment cost

Figure 13.2-21 shows the installed PV capacity per household in the case of the SHS electrification rate of 40% and the BCS electrification rate of 20%. Clearly, electricity demand by BCS users is much smaller – one fourth – than that by SHS users.

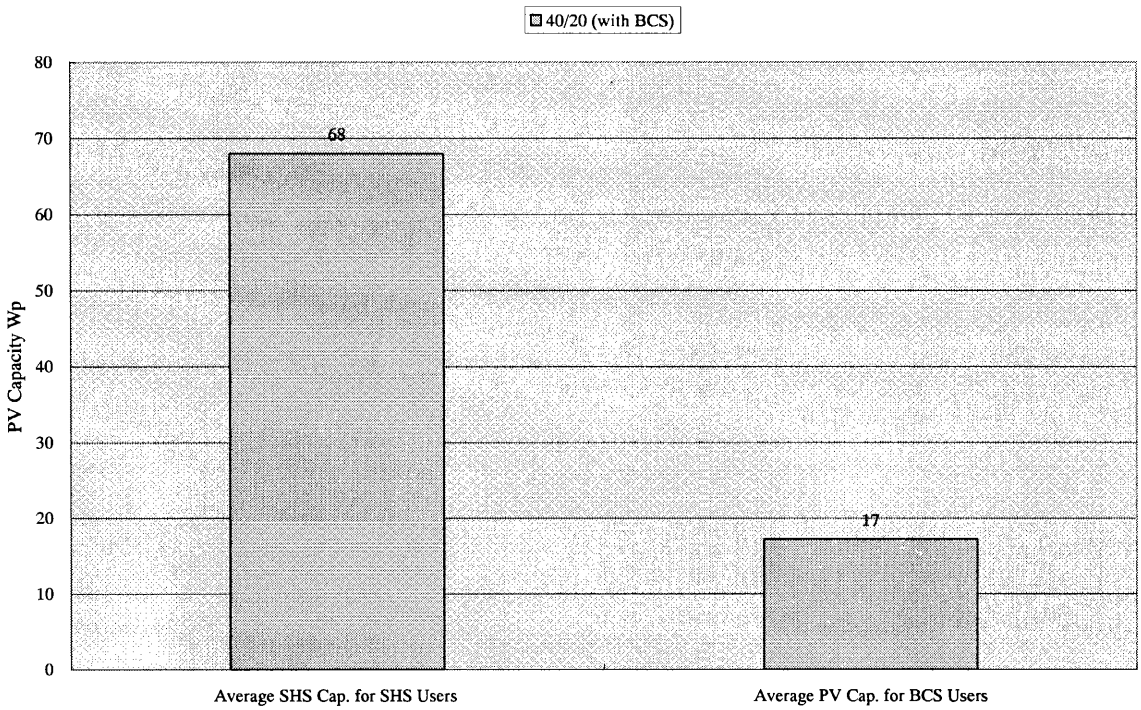

Figure 13.2-21 Average PV Capacity per Household

On the other hand, the investment cost per household is relatively high for the BCS user compared to the SHS user – 70% of the latter – as shown in Figure 13.2-22. This reflects the fact that the BCS equipment cost is higher than the SHS, and the battery box installed at the user premise requires an additional set for the recharging purpose, resulting in a higher system cost.

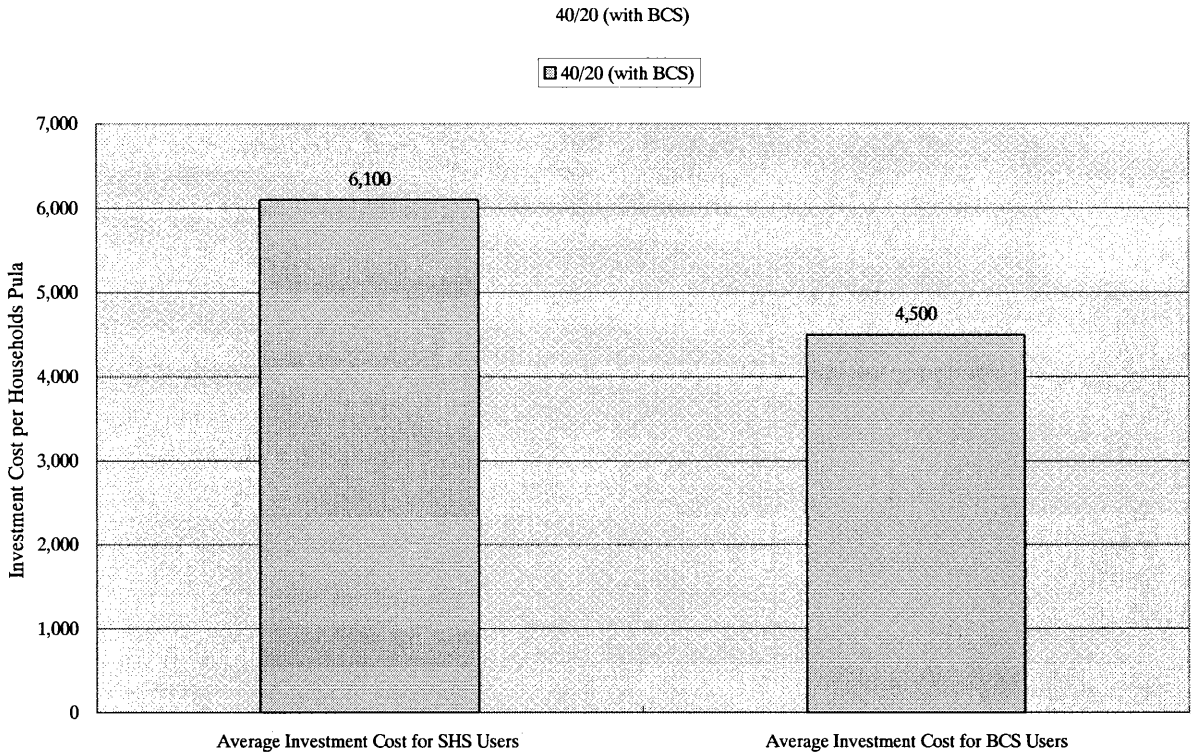

Figure 13.2-22 Average Required Investment Cost per SHS and BCS User

2) Operating cost

While the BCS requires more work than the SHS, such as the recharging and the transportation of batteries, the operating cost cannot be reduced much because the local operating unit will be responsible for much of manual work. On the other hand, cost reduction at the Implementation Body's office has significant impacts, as discussed earlier.

3) Effect of cost reduction

Figure 13.2-23 shows the effect of the 30% decrease in BCS equipment cost, which causes the IRROI to improve approximately 0.5%.

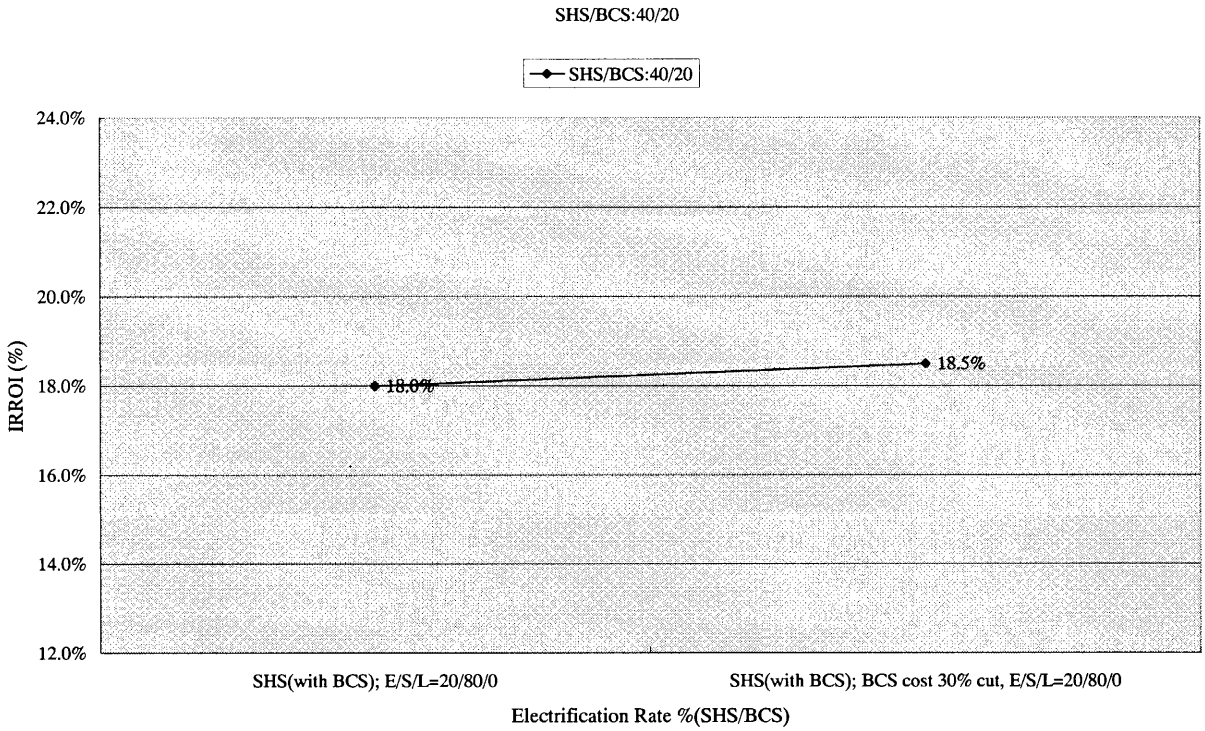

Figure 13.2-23 IRROI Improvement of SHS/BCS System per 30% Cost Down of BCS Investment Costs

4) Comparison of SHS only and SHS/BCS

The results of the comparative analysis are summarized in Table 13.2-2. While the BCS is not financially attractive because of lower profitability than the SHS, it is considered to be an important vehicle to promote electrification of the low income communities. At the same time however, efforts should be made to ensure: a) effective reduction of the equipment cost; and b) improvement of system operation and management.