Solar Home System (SHS) Price analysis

July

2011

Price analysis of Solar Home System (SHS) sold under the subsidy scheme of Government of Nepal.

Analysis by Solar Energy Component, AEPC/ESAP

Table of Contents

List of figures

List of Tables

List of Abbreviations

AEPC	Alternative Energy Promotion Centre
Ah	Ampere hour
CFL	Compact Fluorescent Lamp
DDC	District Development Committee
ESAP	Energy Sector Assistance Programme
GoN	Government of Nepal
HH	House Hold
KfW	Kreditanstalt für wideraufbau
MOLD	Ministry of Local Development
MRP	Maximum Retail Price
NEPQA	Nepal PV Quality Assurance
NPR	Nepali Rupee
NPV	Net Present Value
SAF	Subsidy application form
SEC	Solar Energy Component
SHS	Solar Home System
SSHS	Small Solar Home System
VDC	Village Development Committee
W	Watt
Wp	Watt peak

1 Background

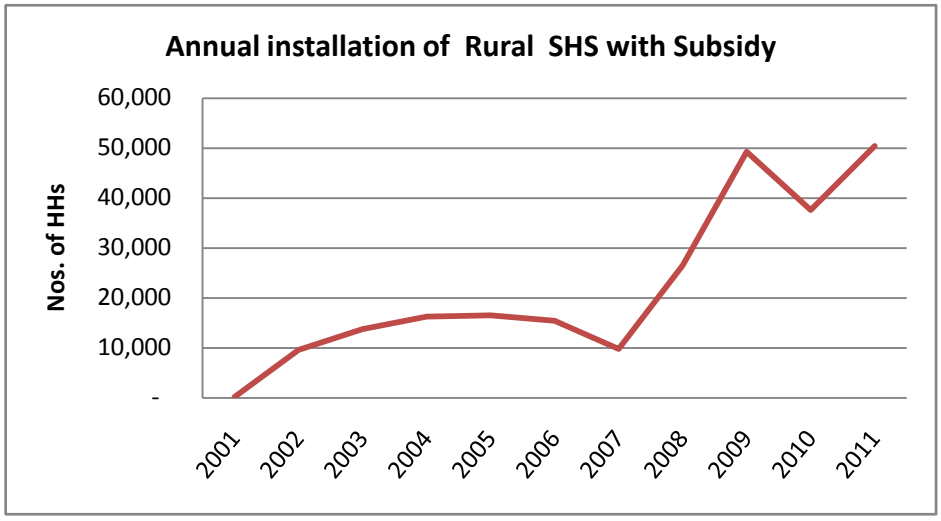
The Energy Sector Assistance Programme (ESAP) is a programme under AEPC supported by the Governments of Nepal, Denmark, Norway, Germany and UK. The Solar Energy Component (SEC) of AEPC/ESAP is supporting rural electrification through the dissemination of Solar PV Systems. AEPC/ ESAP support has facilitated a significant increase in the use of solar PV as a source for rural energy over the past 11 years.

To date, AEPC/ESAP has supported installation of more than 250,000 Solar Home Systems (SHS) and 11, 000 Small Solar Home Systems (SSHS) in 2,500 VDCs of 73 districts in Nepal. The installation of SHS increased sharply after start of AEPC/ESAP subsidy from 2000/01

At times when subsidy was stopped due to lack of funds, the installation of SHS drastically reduced as shown by Figure 1. During ESAP I (2001 -2004), the installation of SHS increased. During the extension of ESAP I (2005 – 2006), no subsidy was available and the installation rate decreased. From the start of ESAP II in March 2007, subsidy was again made available, and the installation rate increased sharply. ESAP II funds for subsidising SHS were depleted in mid 2009 and again there was a sharp decrease in the SHS installation rate. When KfW joined, and funds were made available the installation rate increase again. The annual installation rates are shown in Figure 1.

The installations in rural areas without subsidy are few and so are the installations in urban areas. Only during reset severe load shedding, the urban installations have started to pick up.

Figure 1: Annual Installations of SHS.



Subsidy is a key financial intervention in the policy of Government of Nepal to promote rural and renewable energy. Thus, it is clear that SHS installation has decreased sharply when there was no subsidy. This implies that the sale of SHS is subsidy driven in rural Nepal.

2 Nominal Subsidy Amount for SHS

GoN (AEPC) has defined a subsidy amount varying depending of remoteness of the location and size of the SHS. The last revision of subsidy on SHS was made in 2006 and is as shown in Table 1.

Table 1: Subsidy on SHS, 2006

Category	Geographical Location	10-18 Wp (NPR)	More than 18 Wp (NPR)
A	Karnali and adjoining districts* and very remote VDCs categorized A in other districts	7,000	10,000
B	Remote VDC categorized B in other districts	6,000	8,000
C	Accessible VDCs	5,000	6,000

Category A : Humla, Jumla, Kalikot, Dolpa, Mugu, Rolpa, Rukum, Jajarkot, Bajhang, Bajura, Achham, Dailekh, Darchula and some of the very remote VDCs of other districts.

Category B: The remote VDCs of the remote districts.

The category “A” comprises of very remote VDCs, while category “B” represents remote VDCs as specified in the Annex-1 of subsidy arrangement 2009.

Category C: All the accessible VDCs where no other means of electrification is there.

These categories are defined by Ministry of Local Development (MOLD)/GoN notification in the Nepal Gazette 2006 publication.

3 Costs of SHS

Solar panel, battery, charge controller, lamps, and other accessories are the components of a complete Solar Home System. Nepal does not produce solar panels and these are imported. Nepal only has a limited production of batteries, charge controllers, and lamps, and the larger part of these are also imported.

Government of Nepal has set a minimum standard for SHS components in NEPQA and has exempted import tax and VAT on compliant components. Only NEPQA compliant products are eligible for subsidy. To achieve tax exemption the companies submit their Pro-forma Invoice to AEPC and therefore, AEPC has detailed statistics on costs of SHS components imported in different years.

For this analysis of the average costs of a SHS is calculated using the costs stated in the Pro-forma invoices. Adding the cost of accessories and services to the import costs, the end-user costs of SHS is calculated. Some informed assumptions and surveys of few companies were made randomly to support calculation of the cost of services. The calculated prices are then compared with the price stated in the SHS Subsidy Application Forms (SAF).

Following tables and graphs show the cost development of SHS components during the years 2008-2011.

3.1 Import Costs of SHS Components

Table 2: Import costs PV panels, NPRs

	Year	2008		2009		2010		2011	
	Wp capacity	20	40	20	40	20	40	20	40
Product	Tata BP, India	4,100	10,100	3,920	8,800	3,920	8,640	3,700	8,400
	Solarland		11,400		10,500		9,000		5,760
	Everexceed, China	3,500		3,000		3,000		3,000	
	Waaree, India			2,500	5,500	3,000	5,248	2,500	5,248
Average price		3,800	10,750	3,140	8,267	3,307	7,629	3,067	6,469

Table 2 show that the costs imported 40Wp PV panels has decreased significantly while the costs of 20Wp panel show minor decrease.

Table 3: Import costs of battery, NPRs

		Year			
Product of	**Capacity Wp**	**2008**	**2009**	**2010**	**2011**
Rahimafrooz, Bangladesh	35		3,728	3,278	3,170
Kulayan Battery, Nepal	35		3,172	3,200	3,200
Average costs of 35 Ah			3,450	3,239	3,185
Unikor, Korea	36	2,840	3,000	3,000	2,600
Rahimafrooz, Bangladesh	45	2,550			
Kulayan Battery, Nepal	45	3,500			
Rahimafrooz, Bangladesh	55		4,917	5,120	4,752
Kulayan Battery, Nepal	57		5,300	5,200	5,300
Unikor, Korea	70	4,900	5,100	5,064	5,184
Rahimafrooz, Bangladesh	75	3,721			
Kulayan Battery, Nepal	75	5,500	7,200	7,200	7,300
	80		6,950	6,854	6,624

Table 3 show that except for the 75Ah, the import costs of all other batteries has been constant or decreased slightly, whereas the imports cost of 75Ah battery has increased substantially from 2008 to 2009.

Table 4: Costs of import of charge controllers, NPRs

		Year			
Product	**Capacity Ampere**	**2008**	**2009**	**2010**	**2011**
AKW, India	5 Ampere	750	650	650	650
AKW, India	10 Ampere	1,050	950	850	850
Macon, India	8 ampere	550	450	450	450
Macon, India	10 Ampere	650	500	480	480
Shijitek, India	6 ampere	350	350	350	350
Shijitek, India	8 ampere	500	500	450	450

Average cost of	5 Ampere CC	750	650	650	650
Average cost of	6 ampere CC	350	350	350	350
Average cost of	8 ampere CC	525	475	450	450
Average cost of	10 Ampere CC	850	725	665	665

Table 4 show that import costs of all sizes of charge controller has decreased from 2008 to 2010 and are constant in 2010 to 2011. The costs of AKW India are higher than those of other companies.

Table 5: Import costs of lamps, NPRs

Product of	**Capacity**	**Year**			
		2008	**2009**	**2010**	**2011**
Solar land, China	6 watt	450	400	400	390
PT Sundaya, Indonesia	10 watt	415	380	380	372

Table 5 show the import costs of lamps. The import costs of 6 watt Solarland and 10 watt PT Sundaya lamps have decreased from 2008 to 2009 and remained constant afterwards.

3.2 Costs of Accessories

Besides the above major components the following are accessories required for a SHS installation:

1. Panel supporting structure.
2. UV cable for outdoor wiring.
3. Colour cable of different sizes for indoor wiring.
4. Junction box for cable connection.
5. Switches.
6. Wire fixtures.
7. Cable shoos.

Cost of accessories depends on the capacity of SHS, the higher the capacity the larger will be the support structure, further, the number of lights will add to the cable length, switches and wiring fixtures. Therefore, for this analysis the accessories for cost of 20 and 40 watt SHS for the year 2011 has been estimated as NPRs 2,000 and 2,500 respectively. The costs for the previous years are estimated by a reduction factor equal to the inflation rate of 10 % for last couple of years.

Table 6: Estimated average cost of SHS accessories, NPRs

Capacity	**Year**			
	2008	**2009**	**2010**	**2011**
20 watt	1,503	1,653	1,818	2,000
40 watt	1,878	2,066	2,272	2,500

As shown in Table 6 the costs of accessories have decreased in same pattern.

3.3 Cost of a Complete Solar Home System

A complete SHS contains each set of the above mentioned components. The major variable that varies with the system capacity is the average number of lamps. In the current market practice 3 lamps are used for 20 watt peak and 5 lamps for 40 watt peak SHS, so these data are considered for calculations of the total costs of a complete SHS. A 20 watt peak system required 35/37 Ampere hour battery, 5/6 ampere charge controller and 40 watt peak required

55/57 Ampere hour batteries and 8/10 ampere charge controller to meet NEPQA standard, therefore average costs of these respective sizes are used to calculate the total costs of import.

Table 7: Total costs of a complete SHS

Year	**2008**		**2009**		**2010**		**2011**	
Capacity in watt	**20**	**40**	**20**	**40**	**20**	**40**	**20**	**40**
Components	NPRs							
Panel	3,800	10,750	3,140	8,267	3,307	7,629	3,067	6,469
Battery	3,145	5,108	3,225	5,108	3,119	5,160	2,892	5,026
Charge controller	550	687	500	600	500	557	500	557
Lamps	1,297	2,160	1,170	1,950	1,170	1,950	1,143	1,905
Accessories	1503	1,878	1,653	2,066	1,818	2,272	2,000	2,500
Total price of a SHS	10,295	20,583	9,688	17,991	9,914	17,568	9,602	16,457

Table 7 show the import cost of a complete 40 Wp and 20 Wp SHS and that the costs of 40Wp system has decreased substantially whereas the cost of 20 Wp show a minor decrease.

3.4 Cost of Services

The costs calculated above are import costs (from the Pro-forma Invoice) at delivery point of the supplier. Several costs occur from the port of entry to the house using the SHS. To get realistic cost of these accessories and services some qualified companies were randomly visited to register these costs. The import costs in different currencies were converted to Nepalese rupees at the current exchange rate at the time of importing, thus the effect of changing exchange rates are included.

This analysis considers the following as costs of Services for a SHS.

Clearing and forwarding costs: The cost incurred for custom clearance, shipping clearance, insurance, handling charge, and transportation from port of entry to assembly venue.

Transportation cost per SHS: The costs of transporting the Solar Home System from the assembly venue to the user.

Installation cost per SHS: The charges paid by the company to the Agent/Level I technician for installation of the system at user house.

ASS cost per SHS: The costs of providing after sales service to the user, including the two preventive maintenance visits to each user.

Warranty cost per system: The costs of honouring the warranty claimed by the user.

Subsidy Application The costs of preparing the Subsidy Application Form, required, subsidy application form charge, MIS data base management, staff for processing Subsidy Application Form

Operating cost: The costs of operations, including salary & wages, communication expense, stationary, building rent etc.

Other costs: It includes the cost incurred as a result of bad dept, as per companies this is fairly high.

Table 8 gives the detail of the costs of the above explained service items, collected randomly from pre-qualified companies.

Table 8 Costs of Services

Cost items	**Category**	20Wp				40Wp			
		2008	**2009**	**2010**	**2011**	**2008**	**2009**	**2010**	**2011**
Clearing and Forwarding costs		1,820	1,720	848	1,212	2,504	2,392	1,895	1,799
Average Transportation costs per SHS	A	800	800	1,033	1,033	800	800	1,033	1,033
	B	250	500	500	750	500	500	750	750
	C	400	400	500	500	400	400	500	500
Average Installation costs per SHS	A	750	750	750	750	750	750	750	750
	B	800	800	650	650	800	800	650	650
	C	600	600	567	567	600	600	567	567
ASS costs per SHS	A	900	1,000	1,000	1,000	900	1,000	1,000	1,000
	B	800	800	900	900	800	800	900	900
	C	600	600	800	800	600	600	800	800
Warranty costs per		982	914	1,621	1,604	1,304	1,115	2,392	2,392
SAF costs per system		375	375	417	417	375	375	417	417
Annual operating costs		1,692	1,632	1,268	1,220	2,478	2,394	1,910	1,814
Others costs		937	844	711	445	1,587	1,363	1,219	1,159

Above costs added to estimate the total cost of services of a SHS installed. Table 9 shows total cost of services in different category subsidy.

Table 9: Total Costs of Services per SHS, NPRs

Category	**A**		**B**		**C**	
SHS capacity in Watt	**20**	**40**	**20**	**40**	**20**	**40**
Year						
2008	8,256	10,698	7,658	10,348	7,406	9,848
2009	8,035	10,189	7,585	9,739	7,085	9,239
2010	7,647	10,615	6,914	10,132	6,731	9,699
2011	7,682	10,363	7,198	9,880	6,731	9,447

Table 9 shows the total costs of services for a 40Wp and 20Wp SHS in different subsidy category (different geographical regions) and it clearly show that services costs for 20Wp system have decreased more than that of 40Wp system.

3.5 Calculated Costs of a Complete SHS

Total end-user costs of SHS, in different categories, are obtained by adding the costs of accessories and services to the total import costs of SHS.

Table 10: Calculated Costs of a 20 Watt SHS, NPRs

Year	Import cost of a complete 20 Watt SHS	Cost of Services in Category			Total calculated costs in Category		
		A	B	C	A	B	C
2008	10,295	8,256	7,658	7,406	**18,551**	**17,953**	**17,701**
2009	9,688	8,035	7,585	7,085	**17,723**	**17,273**	**16,773**
2010	9,914	7,647	6,914	6,731	**17,561**	**16,828**	**16,645**
2011	9,602	7,682	7,198	6,731	**17,284**	**16,800**	**16,333**

Table 10 show that calculated costs of 20Wp SHS is decreasing in all three categories from 2008 to 2011 but the decrease was highest in 2008 to 2009.

Table 11: Calculated Costs of 40 Watt SHS, NPRs.

Year	Import cost of a complete 40 Watt SHS in user-end	Cost of accessories and services in category			Total calculated total costs in category		
		A	B	C	**A**	**B**	**C**
2008	20,583	10,698	10,348	9,848	**31,281**	**30,931**	**30,431**
2009	17,991	10,189	9,739	9,239	**28,180**	**27,730**	**27,230**
2010	17,568	10,615	10,132	9,699	**28,183**	**27,700**	**27,267**
2011	16,457	10,363	9,880	9,447	**26,820**	**26,337**	**25,904**

Table 11 show the calculated costs of 40Wp system and total costs, in all three categories, have decreased substantially from 2008 to 2009 and remained constant in 2009 to 2010 and again decreased in 2010 to 2011.

4 Prices Recorded

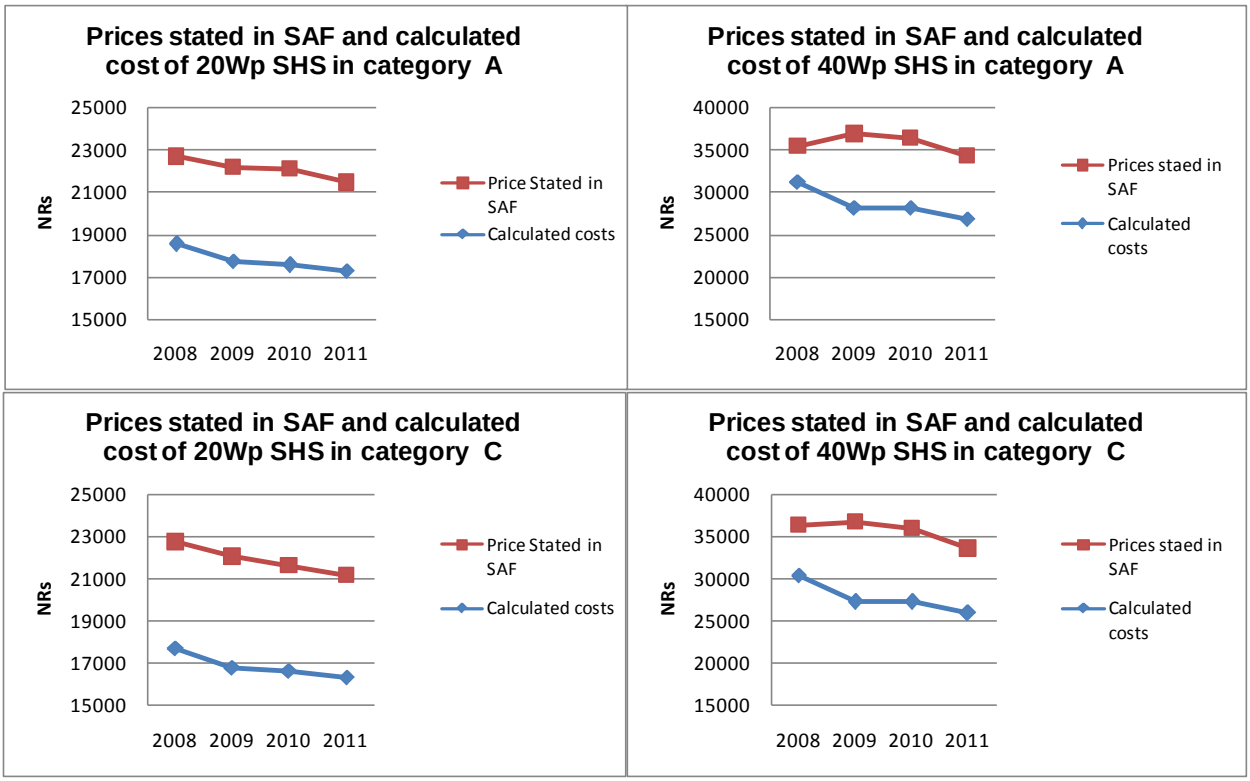
4.1 Price Stated in Subsidy Application Forms

Subsidy is provided to those areas without access to electricity. According to the subsidy delivery mechanism 2009, AEPC qualified companies install SHS in users' houses, deducting the subsidy amount in the selling price, and later claim the subsidy amount from AEPC/ESAP. Submission of the Subsidy Application Form (SAF) and other supporting documents is required for claiming subsidy. Among the entries in SAF is the price. Table 12 shows the average SAF prices of SHS generated from the SEC database. The table shows the average SAF price of 20 and 40 Watt SHS in different Categories (geographical regions) of Nepal. The average price is nearly similar in all four years. When enquired on the issues of high prices, PQ companies inform that they have a system of fixed Maximum Retail Price (MRP) for their agent/dealer. The companies claim that they enter the MRP in the SAF but provide 2,000 to 3,000 NPRs discount to user. This is actually verified by an inquiry of prices by the AEPC/ESAP monitoring and verification teams.

Table 12: SHS price stated in SAF, NPRs

	Price stated in the Subsidy Application Form					
Category	**A**		**B**		**C**	
SHS capacity in Watt	**20**	**40**	**20**	**40**	**20**	**40**
Year						
2008	22,679	35,426	23,749	35,117	22,730	36,291
2009	22,199	36,887	23,335	37,973	22,049	36,786
2010	22,135	36,353	21,551	37,524	21,619	35,946
2011	21,465	34,293	21,257	35,940	21,179	33,565

Figure 2: Price Stated in SAF and calculated costs for 20Wp and 40Wp in Category A and C



The Figure 2 is four graphs. The first two shows the development of prices stated in SAF compared to the total calculated costs of a 20 Wp SHS in category A and C. The graphs show that both are decreasing in parallel. The lower two graph shows development of prices stated in SAF compared to the total calculated costs of a 40 Wp SHS in category A and C. The graphs show that for both category A and C, the SAF prices first increased and then decreased whereas calculated costs decreased from 2008 to 2011.

4.2 Actual Selling Prices Recorded in the Field.

In order to verify user prices as claimed by companies, AEPC/ESAP monitors on field trips collected some firsthand information on the prices actually paid by users. The prices recorded are shown in the Table 13. These prices are a limited number of samples, as registering selling prices previously were not part of the obligations for the teams. In category B only very few systems are deployed and the few registered prices are not included as they are not considered to be representing the.

Table 13 Prices registered by monitoring teams, NPRs

Category	A		C	
SHS capacity in Watt	**20**	**40**	**20**	**40**
Year 2011	20,000	30,000	17,500	27,000

5 Correction for Inflation

In all the previous tables all prices and costs were shown in prices of the year. In the following the figures are in 2011 NPRs price level. The Inflation figures used to inflate the prices of the year is shown in Table 16.

Table 14 Inflation of Nepalese rupees in the period

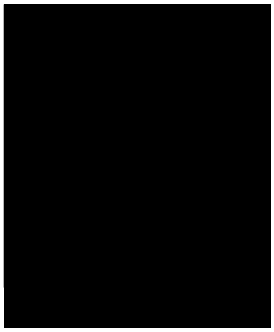


Table 14 show the Gregorian calendar-year inflation based on Nepal Rasta Bank figures reported for the Nepali Fiscal Year.

The present subsidy for SHS was set in 2006 as an amount in NPRs and in 2011 it is still the same amount in NPR (shown in Table 1). From 2006 the inflation has undermined the value of the subsidy and in the tables below the value of the subsidy is stated in fixed 2011 prices and the cost and selling prices of SHSs are stated in 2011 prices.

Table 15: Fixed 2011 Prices in NPRs, Cost of a 20Wp SHS on Site, Subsidy, and Subsidy %

Table 15 shows for 2008 – 2011 the Subsidy amounts and the calculated costs of a 20 Wp SHS in fixed 2011 prices. In the Table the subsidy percent is calculated for the three geographical locations.

As the costs of a SHS decreased over the years (in prices of the year) so are the prices when stated as fixed 2011 NPRs. The percent of subsidy also changed. Measured in 2011 prices, the subsidy in 2008 equalled 54% in Category C, 44% in Category B, and 34% in Category C. In that sense, the Subsidy worked as intended as the less accessible areas (assumed to be home for the poorer households) got the highest percentage. The percentage has increased slightly over the years as the costs of a SHS decreased faster than the inflation undermined the amount of Subsidy.

Table 16, below, shows a similar calculation for a 40Wp SHS.

Table 16: Fixed 2011 Prices in NPRs, Cost of a 40Wp SHS on Site, Subsidy, and Subsidy %

Table 16 shows for 2008 – 2011 the inflated Subsidy amount, the inflated calculated costs of a 40 Wp SHS, and the Subsidy percent in the three geographical locations.

As it appeared from Table 15, the costs of the 40 Wp SHSs decreased faster than the inflation undermined the Subsidy. As the subsidy is the same regardless of the size of the SHS, the percentage of Subsidy is considerable lower for a larger and more expensive SHS. As for the 20Wp SHS the percentage of Subsidy is higher in the less accessible areas. Also for the 40Wp SHS, the percentage of subsidy increases slightly over the years.

Table 15 and Table 16, shows the calculated costs of a SHS. To test the assumed costs against the verified the actual selling prices, the ESAP monitors were asked to record the price paid by the households. For now only a few monitors has reported and their records are shown in Table 17.

Table 17: Calculated Cost, Actual Selling Price, Net Profit, and Subsidy Percentage for a 20Wp and a 40Wp SHS, fixed 2011 price level

Table 17 shows the calculated costs and the recorded selling price (or the price paid by the consumer) for a 20WP and a 40Wp SHS. The actual selling price is based on memory of the consumer as none of the households asked could produce a tax-invoice as a no tax-invoice was issued by the companies selling the SHS.

From Table 17 it appears that the companies selling SHSs, cash a net profit (before tax) of 4 - 16%. The Subsidy percentage is lower on the after profit selling price, but as the net profit is moderate to low, the subsidy for the consumer is still considerable.

6 Feasibility for Households

When considering if the pay-off on the investment for the households, the assumption on the yearly savings for other means of light are essential as it is to a high degree determining the result. The price for a SHS is fairly well known compared to the amount of saving the households are experiencing. As each household have their own habits, two households looking equal from an observer's point of view, will experience difference in savings. For the feasibility the assumed savings are shown in Table 18.

Table 18: Assumed savings for light experienced by different income level households

Table 19 shows the Net Present Value (NPV) 5% for different households. The low and middle income HH are assumed to install a 20Wp SHS and the high income HH is assumed to install a 40 Wp SHS. The lifetime of the system is assumed to be 20 years, the battery to be changed three times over 20 years, and the yearly cost for maintaining the system at a level of 200 NPRs per year the first years of operation and then increasing. The NPV is calculated using 5%

discount rate, reflecting the real interest of a loan from a financial institution. However, a rural HH might only be able to achieve a loan at a higher interest – if they can achieve a loan at all.

Table 19: 20 years NPV 5% for selected Households

The calculations are made with and without subsidy for a SHS installed. The results that a low income HH will experience a negative NPV and the higher income HH will experience a positive NPV is not surprising. However, the results show that from a strict financial analysis only the low income HH actually need the Subsidy. One thing is a strict financial analysis and other is reality for the HH. Regardless the income, many HHs might struggle to find the cash for the initial purchase especially the low income HH and a large part of the middle income groups. Those struggling finding the cash are considered to be the majority of HHs.

The financial analysis assumes a lifetime of a SHS to be 20 years, and that might be right in technical terms. However, the financial lifetime might be much shorter as other means of electricity could be made available before the 20 years has elapsed. Thus, reducing the lifetime to 10 years will entail negative NPVs for all income groups if no subsidy is provided.

Table 20: 10 years NPV 5% for selected Households

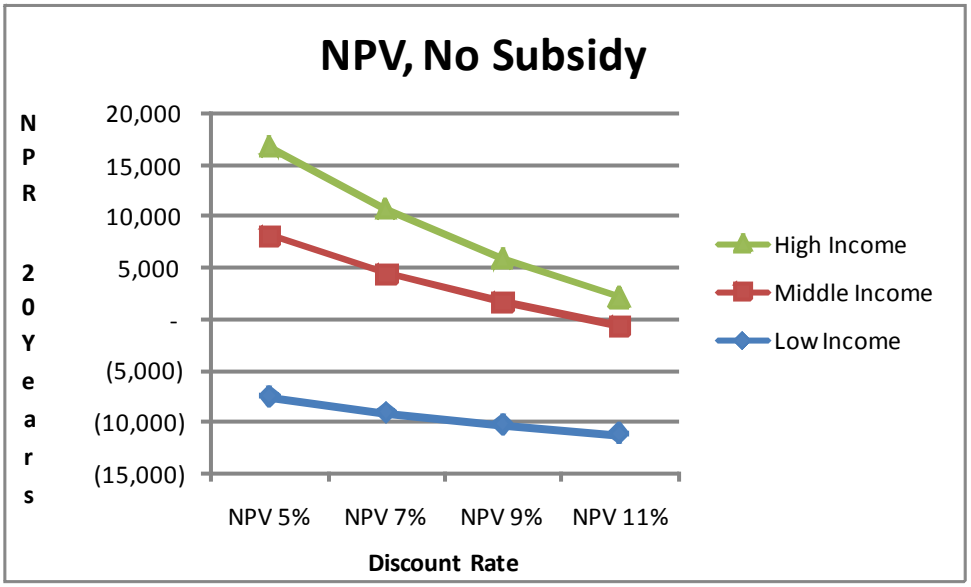
If other means for electricity are made available it is most likely the high income and part of the middle income groups that will shift supply and not the low income group. Those shifting could sell their SHS and by that regain their loss.

Another question not answered by a strict financial analysis is, if a household allow themselves to think or even consider a 20 years period, or even a 10 years period? The answer is very much depending on other factors such as considerations of sustaining livelihood for such a period, development of economy, urbanisation, etc. The most likely outcome of such considerations is that it is very unlikely that a HH see themselves as poor and in a particular place for 20 years, accepting it, and then acting financially rational as a consequence. It is in the human nature at least to plan for changing an undesirable position and act, more or less conscious, according to the planning, thus considering any purchase as more or less temporary.

6.2 Sensitivity

A determining parameter in the calculations is the discount rate. For the calculations 5% is used as the real interest rate on a loan, though it might only be obtainable in an urban setting. In a rural setting the real interest rate might be much higher. NPV for different discount rates are shown in Figure 3. Despite the considerations on the financial and the technical lifetime of the SHSs, a 20 years lifetime is used.

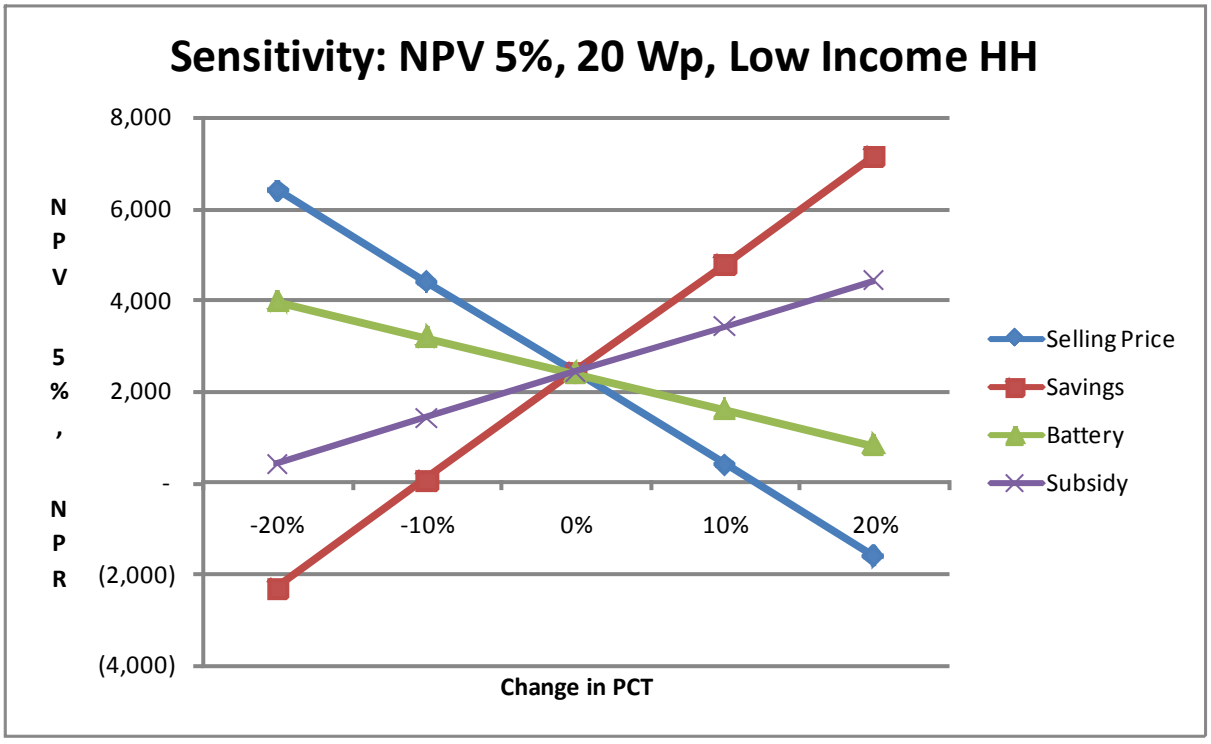
Figure 3: 20 years NPV for various Discount Rates, No Subsidy



If no subsidy a low income family will experience a negative NPV for the analysed discount rates. Even with 0% discount rate the NPV will be negative for a low income HH. The result confirms that low interest loans can create a financial incentive for a rural family, but for the low income HH the interest must be negative to create a financial incentive.

An investment with 20 years lifetime is sensitive to changes in relative prices. To analyse the impact of changes in prices some sensitivity analyses are made. Change in selling price, price for replacing battery, assumed savings, and Subsidy are made. The changes are +/- 10% and +/- 20%. The result is shown in Figure 4.

Figure 4: Sensitivity for a Low Income HH, with Subsidy



The figure shows that the most sensitive parameter is the savings experienced by the HH, and that the result is also sensitive to the selling price. Changes in the price for battery change and the level of Subsidy have less impact on the result.

The most likely financial outcome is a NPV of a little more than 2,000 NPV for a 20 years period. Considering the sensitivity of the outcome to changes in savings, makes it a very risky investment for a HH. A risky investment with a possible pay-back of 2,000 NPRs over a 20 year period is highly unlikely to create financial incentive to install a SHS. Other incentives must be motivating and that is most likely is the desire to enjoy the benefits of electric light.

In other words, HHs is not making a decision based on a rational financial analysis, but on the result on other incentives and definitely the availability of cash to actually pay for the SHS. This is not a surprise as most households, urban and rural, make decisions with financial implications based on other incentives than financial when buying, motorbikes, cars, smart-phones, etc. The key for the households is the availability of money to buy the desired things.

7 Findings

Following are the findings of the analysis.

- In the Nepalese market SHS components with different price range are used and with different combination of components, the SHS price for the same system capacity varies.
- The selling prices vary with the cost of services which also depends on the commitments to After Sales Service and Warranty. This also adds to the difference in prices of equally equipped SHS.
- The price of solar panel on the international market, and therefore also in Nepal, has decreased over the last couple of years but the prices of batteries, charge controllers, and lamps are almost constant.
- In general, the selling price of a SHS in Nepal is higher than in other countries, said to be due to the size of the market (economy of scale) and cost of services unique to the requirements for achieving subsidy (testing, After Sales Service, etc).
- The import costs and selling prices of systems eligible for subsidy are decreasing in the similar pattern.
- Average prices to the given demand/supply quantity in Nepal and in India are similar however the prices in Bangladesh are lower which can be attributed to the huge long term demand. However, the pattern of price change in Nepal and in Bangladesh is similar.
- Solar companies have practiced to state MRP in SAF however their actual selling price is lower, this assumption is supported by the prices randomly recorded by ESAP field-monitors.
- The SHS market in Nepal is subsidy driven. This shows in the periods without subsidy, a slowdown of the installations.
- Inflation in Nepal over the last years has undermined the factual value of the subsidy. However, the nominal prices of SHSs have decreased over the period and the Subsidy percentage has only increased slightly. The main purpose of giving higher subsidy to remote areas has been preserved.
- The feasibility analysis for a HH shows that for the middle and high income groups the purchase of a SHS returns a positive amount when considering a 20 year period.
- The financial outcome is highly sensitive to changes in the savings on other means of light, and a kerosene lamp cannot power a radio or TV, nor charge a mobile phone. The savings experienced are the single most uncertain of the elements in the analysis.
- The analysis of impact on the financial outcome assuming different discount rates to some degree confirms that low interest loans is a key for rural HHs, but for the low income rural HH even a 0% loan cannot create a financial incentive.

8 Conclusions and Recommendations

8.1 Conclusion

This analysis has shown that prices of SHS have decreased by approximately 20 % over the last 4 years. The trend of change in costs of import and the change in selling price of SHS in Nepal is parallel and decreasing. The cost of services which are made mandatory in subsidy delivery mechanism to solar companies is high. When considering prices in other countries these factors are usually not been considered, nor are these costs considered when buying a small SHS on the market in Kathmandu.

The selling prices of SHS with subsidy are on the higher side and that has been from the very beginning of the subsidy programme, as the programme(s) has let the price be determined by the market and required ASS and other services. In a small and supply driven market, the price could easily be controlled by supplier.

However, the annual inflation decreases the real worth of the Nepali Rupee, entailing that buyers during recent years are getting SHS in cheaper compared to previous years.

The calculated net-profit for the companies seems moderate and cannot motivate for reduction of subsidy or for further regulation of the market. However, as shown, the market volume has increased considerable and that alone could call for revision of revision of Subsidy.

When considering the level of Subsidy, the financial support for other means of providing electricity must be considered. If a village or community has access to a stream that is able to provide electricity from a hydro turbine, the subsidy and “equity” made available from various sources could be as high as 100%. If no stream is available the HHs are left with a less attractive solution and much more expensive.

8.2 Recommendations

- As the Subsidy is stated as an amount, the inflation undermines the value, but not necessary following the development of prices for SHSs. Therefore subsidy amount could also be updated accordingly following a price index on SHSs.
- Analysis of this type of should be repeated every six months in order to know the development of prices of SHS over period of time.

8.3 Limitation of the Analysis

This price analysis is the first attempts so it took fairly long time and it uses the limited data and may not portray a full picture but it definitely gives a broad idea how the costs, prices and subsidy are developing over the period of time.

Annex 1: Prices in neighbouring countries

1 Prices in Bangladesh

Bangladesh is achieving a great success in promoting solar PV to meet rural household electricity demand. Currently around 150 million people in Bangladesh have no access to electricity. According to the Infrastructure Development Company Limited in Bangladesh now five million people benefits from over one million households which were only 7,000 homes in 2002. They have crossed the one million SHS installation target and have set a new target to cross 2.5 million SHS installation by 2014. With such a massive demand in Bangladesh the prices per SHS has also changed significantly. Table 16 gives the prices in Bangladesh.

Table 21: SHS price in Bangladesh

Year↓	Price equivalent to NPRs[1]	
	For 20 watt SHS	**For 40 watt SHS**
2008	14,046	21,069
2009	13,891	23,186
2010	12,037	21,245
2011	10,980	19,380

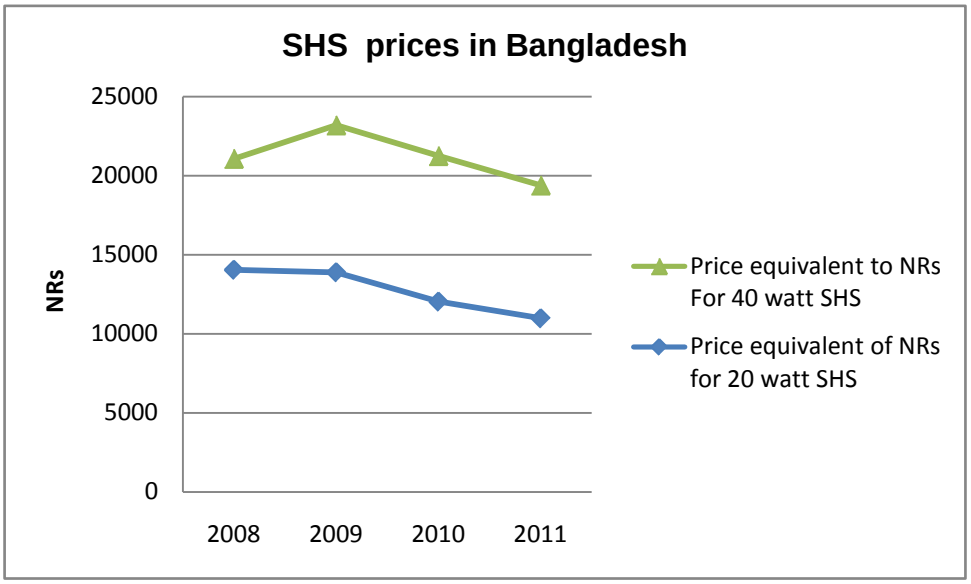


Figure 5: SHS price in Bangladesh

Table 21 and Figure 3 shows that in Bangladesh the prices of 40Wp system increased from 2008 to 2009 and decreased from 2009- 2011 and that of 20Wp system remained more or less constant from 2008 to 2009 and then decreased.

[1] http://wwp.greenwichmeantime.com/time-zone/asia/bangladesh/currency.htm

2 Prices India

Tata BP is leading PV product manufacturing company in India for quite long and is also one of the major PV panel suppliers in Nepal; therefore, their prices are taken as reference. Out of several components' combinations following two can be compared as 20 watt and 40 watt SHS in Nepal.

Jugnu - 2: This is the equivalent to 20 watt SHS which comprises the components as follows.

20W Solar Module, 2x 7W CFL, 12V 30AH Tubular Battery - 2 hours backup, other components like charge controller with 12V 5A, with a battery box, module mounting structure, inter connecting wire/cables switches.

The price of this system in 2011 is NPRs 20,073.

Jugnu - 4: This is equivalent to 40 watt SHS which comprises the components as follows

37W Solar Module, 4 x 11W CFL, 12V 60AH Tubular Battery - 3 hours backup, other components like charge controller with 12V 5A with a battery box, module mounting structure, inter connecting wire/cables, switches.

The price of this system in 2011 is NPRs 31,955.00

3 Comparison of Nepalese prices with that of Neighbouring courtiers

It is true that the samples of prices for India are very few only from Tata BP site but it gives some idea of the prices over there, where as prices of Bangladesh representative as drawn from IDCOL site. Comparing the prices of SHS in Nepal, Bangladesh and India, it is seen that prices of SHS in India and Nepal are similar and that in Bangladesh are lower. As Bangladesh has huge demand and big programme to go up to 2.5 million household by 2014, therefore it has big advantage of economy of scale. As there is big difference in terrain of Nepal and Bangladesh the cost of transportation and services must be high in Nepal.