

FINANCING SOLAR HOME SYSTEMS

BEST PRACTICE EXAMPLE FROM BANGLADESH

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Abstract

Infrastructure Development Company Limited (IDCOL) Solar Home System (SHS) Program is one of the largest and fastest growing off-grid electrification programs in the world. Started in 2003, more than 3.1 million SHSs have been installed under the program, providing clean electricity solution to about 14 million energy starved rural people of Bangladesh. The program has a mission to improve the standard of living of rural people by ensuring access to clean electricity in areas where grid expansion is challenging and/or uneconomical. The program complements the government's vision of "Electricity for All" by 2021. In addition, with 140 MW installed capacity as on May 2014, the program is the major contributor toward the government's strategy of generating 5% of the country's total electricity from renewable sources.

Introduction

Rural population still accounts for more than half of the global population. In Bangladesh, of the 33 million or so households more than 24 million live in the rural areas. Fifteen million rural households do not have access to electricity and still use kerosene lamps for lighting their homes after dark.

Bangladesh is one of the world's poorest and most densely populated nations. Data from the "Household Income and Expenditure Survey 2005" classified about 40% of the country's population as poor and 25% as ultra-poor. Access to modern energy services especially electricity is critical for overall socio-economic development of the country.

Only 40% of Bangladeshis have access to grid electricity and in rural areas it is only 30%. Bangladesh also has a rate of energy consumption that is amongst the lowest of any country in the world, consuming just 220 kW per capita annually. With demand soaring and supply dwindling, Bangladesh faces an imminent energy

crisis, and one that will have far-reaching implications. The Government of Bangladesh has a vision to make electricity available for all by 2021. However, this electrification target cannot be met by the rural grid expansion alone, which is owned and operated by a network of rural cooperatives under the oversight of the Rural Electrification Board (REB). While REB's efforts of constructing 10,000–15,000 km of power distribution lines and connecting nearly 350,000–400,000 new consumers per year is praiseworthy, it would nevertheless require another 30–40 years at the current rate to fulfill the vision.

The countrywide grid expansion will require additional investment of at least USD 10 billion just to set up new generation capacities. Moreover, a large majority of rural households use less than 40 kW of electricity per month, making grid expansion economically unviable without additional operational subsidy. Also, the dispersed nature of rural settlements and numerous rivers, and water courses that crisscross the country, make grid electricity difficult and expensive.

The unique scenario of Bangladesh i.e., large energy starved population who live in densely populated areas creates an enormous opportunity for off-grid electricity solution providers to promote and sell small-scale household energy solutions i.e., solar photovoltaic (PV)-based home lighting systems. Given average household expenditure of Tk. 600–800 per month for 8–12 l of kerosene, this is about USD 2 billion market for just basic lighting.

On this backdrop, Infrastructure Development Company Limited (IDCOL) started its Solar Home System (SHS) program in the off-grid rural areas of Bangladesh. IDCOL is a local financing giant that usually provides long-term debt financing to large-scale energy and infrastructure projects developed by the private sector.

Venturing into the renewable energy sector was a new and risky initiative for the company. Also, this required significantly more operational involvement including awareness building, quality control, training and capacity development, etc., that are not common for a typical debt financier. However, the upside benefits were large and the company looked forward to financing 6 million SHSs by 2016, creating a USD 1 billion new debt portfolio.

IDCOL SHS Program

The IDCOL SHS Program is one of the largest and fastest growing off-grid electrification programs in the world. The objectives of the program are to supply clean electricity in the energy starved off-grid rural areas of Bangladesh and hence, supplement the government's vision of ensuring "Access to Electricity for All" by 2021.

Started in 2003, the program had an initial target of financing 50,000 SHSs by June 2008. The target was achieved in September 2005, 3 years ahead of schedule and USD 2.0 million below estimated project cost (Figure 1). Later, IDCOL revised its target to 1 million SHSs by 2012 which again was achieved in July 2011. Now new target of financing 6 million SHSs by 2016 has been set under the

Financing solar home systems: best practice example from Bangladesh

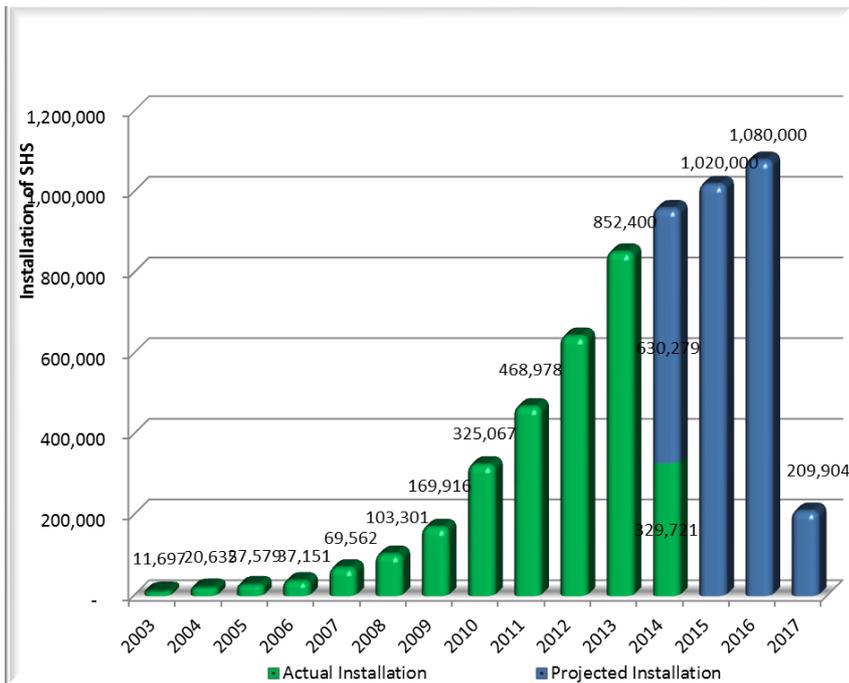


Figure 1: Installation progress of SHS under IDCOL SHS Program

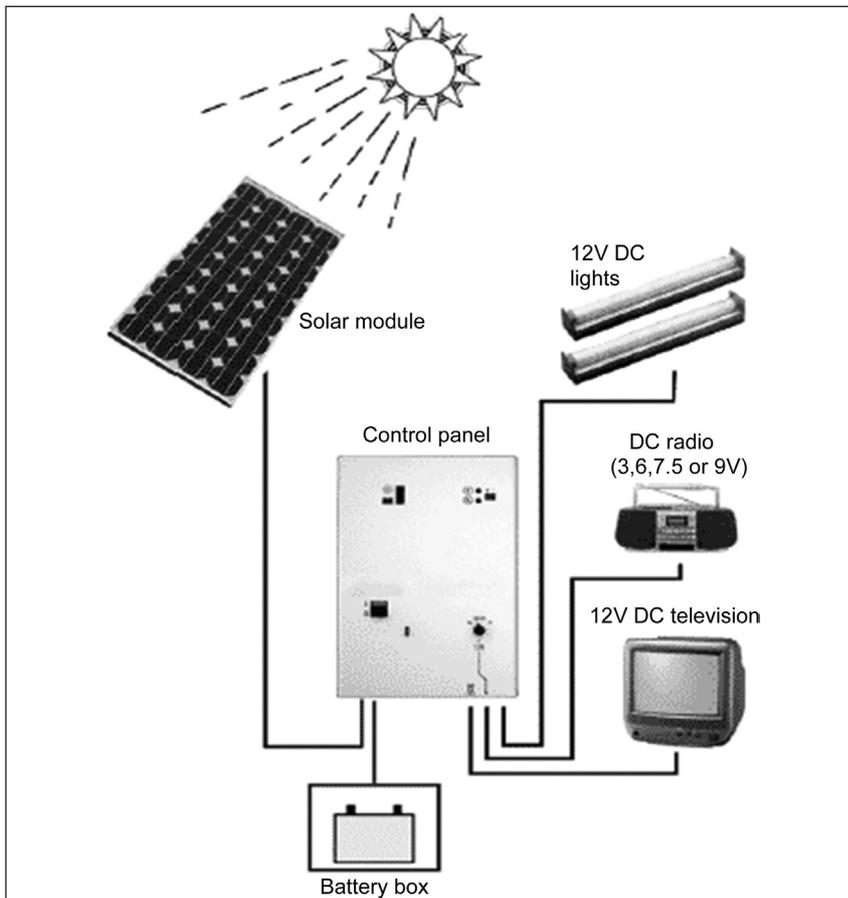


Figure 2: Solar Home System

program and over 3.1 million SHSs with generation capacity of about 140 MW have been installed all over Bangladesh till May 2014.

With funding support from the World Bank, Asian Development Bank (ADB), Islamic Development Bank (IDB), Global Environmental Facility (GEF), German International Cooperation (GIZ), German Development Cooperation (KfW), and Global Partnership on Output-Based Aid (GPOBA), more than 71,000 SHSs are now being installed every month under the program. The total number of beneficiaries under the program is about 14 million rural people, which is more than 9% of the total population of the country. Once the targeted 6 million systems are installed by 2016, the number of direct beneficiaries would be about 27 million people, more than 17% of total population of the country.

Major components

The IDCOL SHS Program has the following major components:

- Provision for buy down grant to eligible households to reduce the purchase price of SHSs;
- Provision for long-term concessionary loans to enlisted Participating Organizations (PO) for them to lend the same to eligible rural households;
- Comprehensive quality control mechanism including enlistment of suppliers as well as solar module/accessories, physical inspection on system performance as well as collection efficiency of POs, etc.;
- Promotional and capacity building support for POs; and
- Training support to PO staffs as well as end users.

The technology

A SHS consists of a PV panel, a battery, a charge controller, and load (Figure 2). When the sunlight strikes the panel, the panel converts the solar energy into electrical energy. The produced electrical energy charges the battery which thereafter can be used to run various electrical appliances i.e., lights, radio, television, mobile phone charger, etc. The charge controller ensures proper charging of the battery and also manages the electrical load distribution of the system.

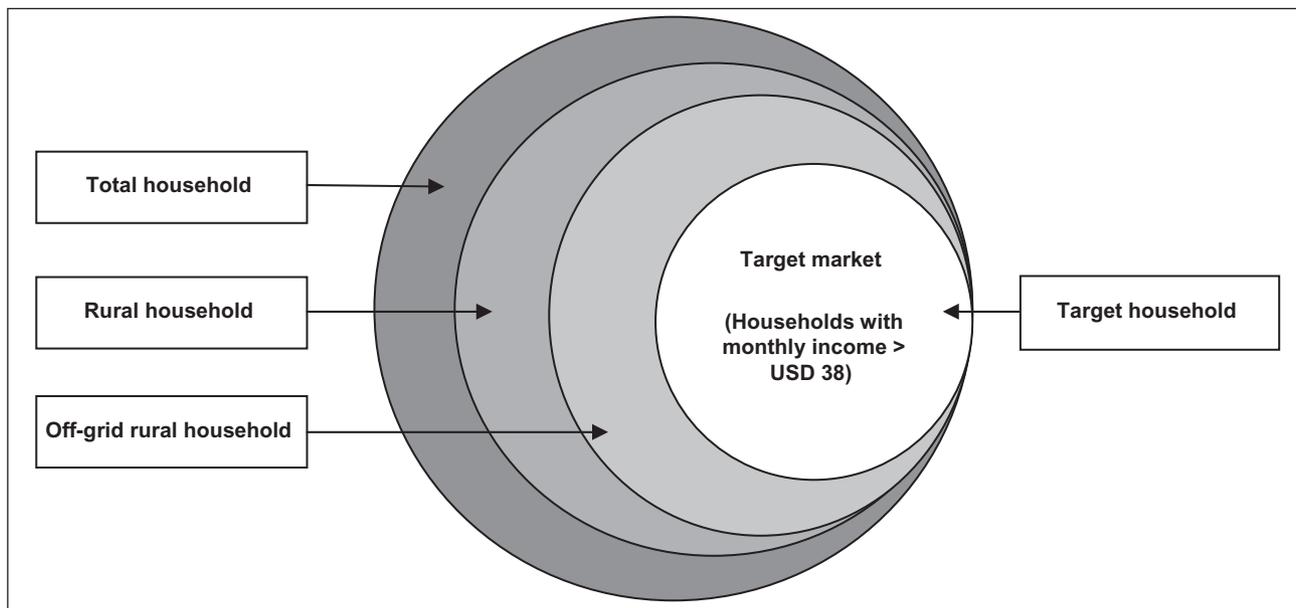


Figure 3: Target market of IDCOL SHS Program

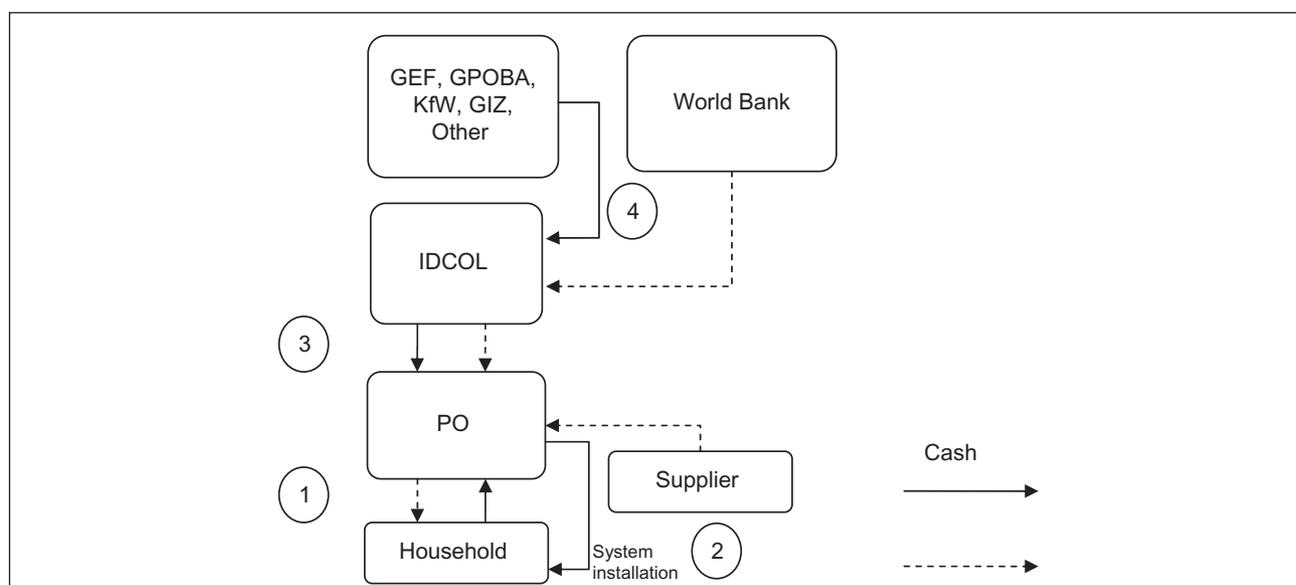


Figure 4: IDCOL SHS Program financing model

The target market

Out of the 24 million rural households in Bangladesh, the program's target group is 15 million who do not have access to grid electricity. IDCOL initially decided to target only 13 million off-grid rural households who have a monthly income of at least USD 38 (Figure 3). IDCOL is considering broadening its domain by entering into the ultra-poor segment of the society, with monthly income below USD 38, to gain access to ad-

ditional 2.2 million potential households. IDCOL developed a number of product packages focusing households in various income groups. The technology, however, has the flexibility to offer various combinations of electrical loads for a particular SHS.

Financing model of IDCOL SHS Program

For the SHS, the program leverages financing from the households, the POs,

grant, and credit support from various development partners through IDCOL (Figure 4). Structure of financing is as follows:

- The households are required to pay minimum 10% of the system cost net of grant as down-payment. The remaining 90% is financed by loan. The lending terms from the POs would be at 12–15% per annum, as in other microfinance services they provide.

Table 1: Financing Structure of a 20 Wp SHS

(a) Market price of 20 Wp SHS	USD 193
(b) Buy-down grant	USD 20
(c) System price for household [(a) – (b)]	USD 173
(d) Down payment from household to PO [10% of (c)]	USD 17
(e) PO loan to household [(c) – (d)]	USD 156
Loan tenor	3 years
Interest rate	16% p.a.
Monthly installment amount	USD 5.4
(f) IDCOL refinance [70–80% of (e)]	USD 109–125
Loan tenor	5–7 years
Interest rate	6–9% p.a.

- On receipt of the down-payment, the POs enter into a sale/lease agreement (provisions of which are approved by IDCOL) and install the system supplied by the supplier. The systems must meet the specifications approved by the independent Technical Standards Committee (TSC) formed by IDCOL under the program to approve quality equipment for the program.
- After the installation, the PO applies to IDCOL to receive refinancing of their loan as well as applicable grant. IDCOL inspectors carry out physical verification of the SHS installed. Based on satisfactory verification, IDCOL provides grant to the POs and also refinances 80/70% of their loan amount extended to the households.
- IDCOL then claims the loan funds used for refinancing from the World Bank, ADB, IDB, or JICA and the grant from GPOBA, GIZ, KfW, USAID, or DFID. On receiving the funds from IDCOL, the PO pays back the suppliers.

The financing structure of a 20 Wp system is shown in Table 1 for illustration purpose:

Success factors of IDCOL SHS Program

The innovative financing mechanism

- The attractive price proposition

In a poor country like Bangladesh, the high initial capital costs of SHS poses a significant barrier to its adoption. Particularly, high cost of solar modules, import items of solar systems requiring foreign currency,

high cost of batteries and of suitable lamps are notable barriers. To resolve the matter, IDCOL initially sourced grant from various development partner to subsidize prices of SHS at the end user level.

- Overcoming the affordability barrier

Even after the attractive price proposition, the target households lacked capacity to make the large upfront investment required to purchase a SHS. Hence, it was required to develop a financing and payment scheme that fitted the target customers' energy budgets. To meet the requirement, IDCOL introduced a credit scheme for the households who could not afford cash purchase. The structure was designed in a manner so that households end up paying almost the same amount as monthly installment that they would otherwise incur to run kerosene lamps.

Fostering sense of ownership

After making full installment payments or one-time payment, beneficiaries become owner of SHS. For this reason, customers were very keen to proper usage and maintenance of SHS. This has been one of the key success factors of the program.

Capacity of SHS has been kept limited to make it affordable to the customers. It has been designed to supply electricity for 4–5 hours during night time to run small appliances such as few lamps, one black and white TV, one mobile-charger, and one DC fan. Otherwise, it would be out of the reach of mass population. Customers will face trouble with the system if they

over-utilize its capacity. Therefore, customer support was necessary for smooth implementation of the program. Ownership concept has been very instrumental in facing this challenge. The idea of becoming owner after full installment payments has also facilitates payment to the POs.

Sustained quality control and after-sales service

SHSs are available for purchase in the major cities at a variety of price and quality combinations. The target customers had a high degree of perceived financial risk associated with their purchase decision — whether the products were worth the price paid. Hence, while introducing the program IDCOL ensured superior quality control and after-sales service which is the major cornerstones of the program. IDCOL has an independent TSC which is responsible for setting technical standards for each of the solar equipments that are sold under the program. Suppliers are bound to abide by such standards as violations would result in a possible termination and blacklisting. Some of the major technical standards and qualification criteria for suppliers are IEC certification for the solar panel, ISO 9001 and 14001 certification for battery manufacturers, 20-year warranty for the solar panel, 5-year warranty for the battery, etc.

IDCOL has 12 strategically located quality control offices all over Bangladesh (Figure 5) and 150 quality inspectors whose role is to conduct random physical verification of the systems installed by the POs to ensure compliance of technical standards as well as note customer complaints. The POs are bound to solve the problems identified by IDCOL inspectors within 7 working days. A dedicated call center at the head office lodges customer complaints and take remedial actions.

Effective promotional strategy

Initially, the target customers were unaware of SHS and its associated benefits, and hence, were suspicious about its performance. Most of the targeted customers lived in the remote rural areas, who are not exposed to traditional media channels, i.e., television, newspaper, billboards, etc.

Reaching to the target group and convincing them by explaining the potential benefits of SHSs was a real challenge.

During the introduction stage, the objective of the promotional campaigns was to create awareness in the selected communities and the promotion themes were based on:

- SHS technology;
- Economic benefit of SHS;
- Easy access of credit;
- Easy operating procedure;
- Warranty service of the product; and
- Socio-economic benefit of SHS.

The various promotional tools that were developed at this phase are presented in Table 2.

The initial promotional theme, however, went through transformation as the company's penetration in the rural market increased over time (Figure 6).

Capacity building initiatives

Limited managerial skills and implementation capacity of grass root organizations (NGOs/MFIs) has been a key barrier for the dissemination of SHS. This stemmed from a combination of inadequate knowledge about available technologies, lack of trained technicians for installation and operation of SHSs, inability to identify and mobilize target groups and effectively market solar equipment and services, and create mechanisms for financing households and solar energy marketing on a business basis.

● **Training programs**

IDCOL conducts training programs to build awareness among the staff of the POs and the customers. IDCOL develops and provides training materials to the POs for these trainings. IDCOL bears major cost of these trainings. Training is provided to the staff of the POs on SHS configuration, positioning of SHS, installation procedure and guidelines with measurements, maintenance and troubleshooting of SHS, guidelines for monitoring and inspection of SHS, market development, micro-credit methods for marketing, and maintenance of battery used in SHS. Seventy five percent of the total expense is sponsored by IDCOL and

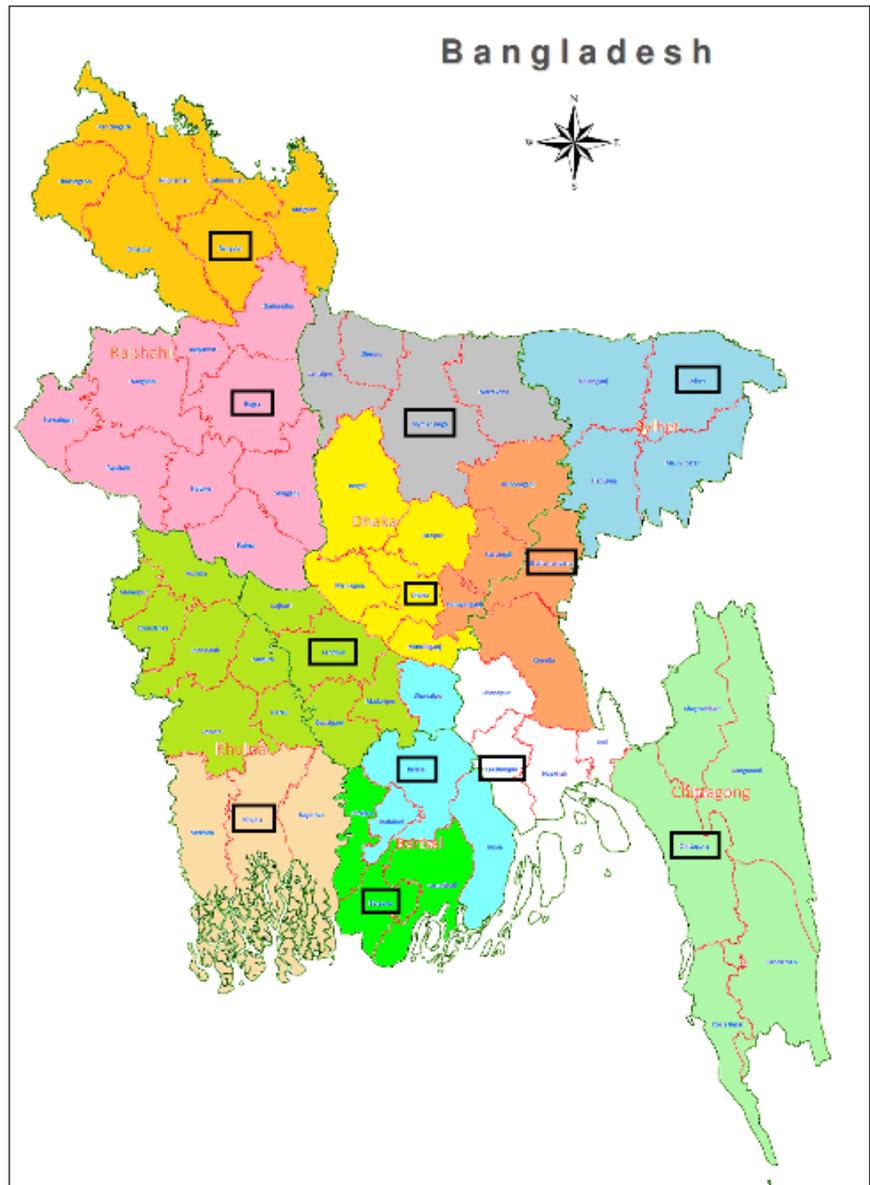


Figure 5: Quality control offices of IDCOL

Table 2: Promotional tools during introduction stage of SHS

Promotion material	Channel
Billboards	Targeted to the selected rural community
Drama	Broadcasted during village fair, customer orientation Television commercial
Street drama	Mostly used in the village markets
Poster	Marked in tea stalls, village market, or any other popular
Leaflet	Distributed among the individual households
Sticker	Tagged in the battery of SHS
Fair	Arrange village fair to exhibit SHS

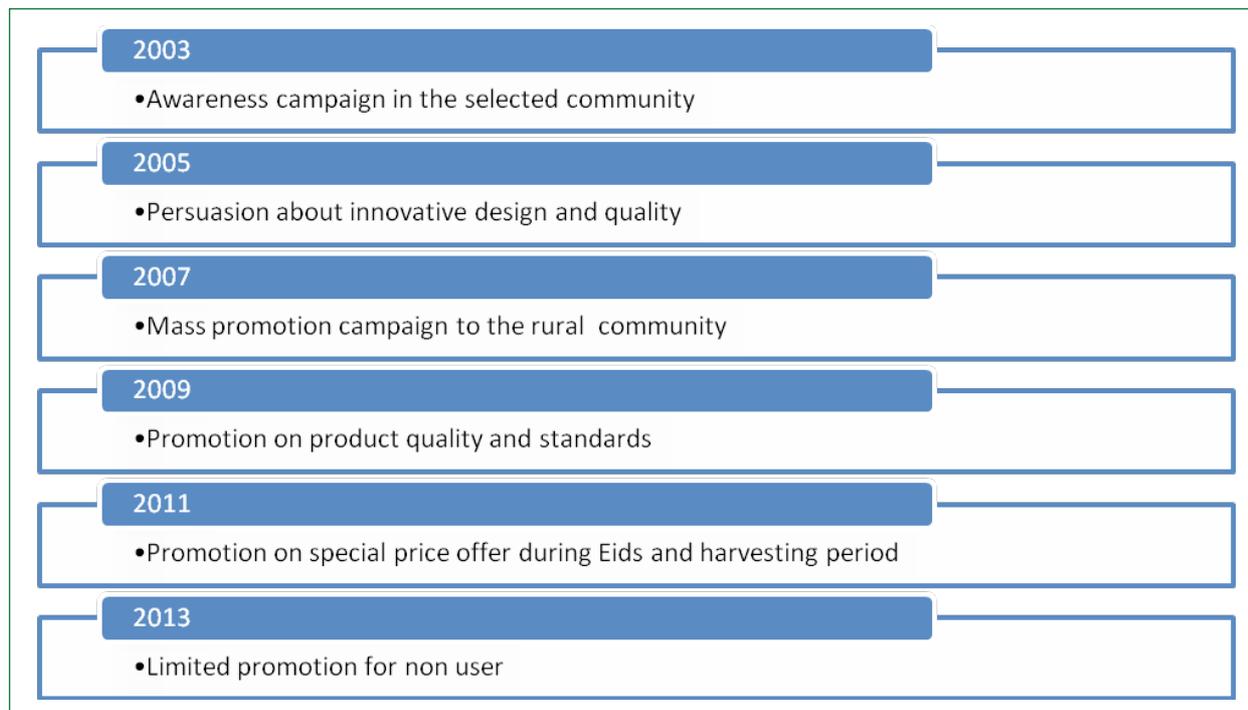


Figure 6: IDCOL's penetration in the rural market of Bangladesh

the rest 25% is shared by the POs. Since SHS is entirely new to the households, consumer trainings are conducted regularly to educate them. They are trained on how to use the SHS and fix petty problems without waiting for the technicians.

• Logistical support

POs are provided with tool boxes, motorcycle, demonstration kit, hydrometers, and battery chargers according to their requisition for rendering better services to customers. Each PO is also given a computer for efficient documentation related to SHS installation. Major share of the costs is sponsored by IDCOL. Logistic supports are provided to the POs as and when necessary.

Leverage existing network of POs

Developing an efficient supply chain network was crucial for the successful dissemination of SHSs. Most of the target customers were located in the remote rural areas, who had little knowledge and a lot of suspicion about the new product. Proactive marketing as well as close physical presence of the suppliers were unavoidable to gain customer confidence.

However, most of the suppliers were based in major cities especially Dhaka and were not convinced to set up offices

or distribution centers in the rural areas due to difficult physical access as well as uncertain demand for SHSs.

One option for IDCOL was to set up its own offices, procure SHSs from suppliers, sell the same to potential customers on both cash and credit, and provide after-sales services. However, IDCOL was an urban financial institution and direct involvement in day-to-day business operations in unknown territories was not part of its competitive advantages. This was also likely to raise the operational cost leading to increased prices of SHSs, making them less attractive to the end user.

The company rather decided to take leverage of the vast network of NGOs and microfinance institutions (MFIs) who were already present in the rural areas and were familiar with rural culture and lifestyle. Since most of the NGOs/MFIs had existing operations, selling of SHSs would be an add-on activity without incurring significant additional operating expenses. Due to their involvement in micro-credit operations, NGOs were also efficient in credit extension and collection mechanism. The NGOs, however, lacked specific knowledge on SHS

procurement, marketing, installation, and after-sales service on which they required training.

Outstanding social and environmental impact

The program has contributed toward creation of more than 70,000 direct jobs, annual fuel subsidy saving of approximately USD 35 million by the government and development of local support industries. Moreover, it has relieved the government from opportunity cost of more than USD 1.2 billion as otherwise would be required to extend grid connection to the households. Due to SHSs, students now benefit from extended hours of studies at night in better lighting condition, small businesses enjoy extended operating hours and women feel more secured at night. Information on education, health, safety, and weather are also easily accessible through television and mobile phones.

The program has also contributed toward the global drive of CO₂ emission reduction. The existing 3.1 million SHSs installed under the program reduce approximately 528,000 tons CO₂ annually. Reduced burning of kerosene has also positive health impact created through

reduced indoor pollution, release of toxic fumes as well as potential fire hazard.

Real life case studies

- Mujib, a 32-year-old shopkeeper has seen his income increased by 1,000 Tk/month and his evening business grew since his system was installed 2 years ago. Customers enjoy the TV and the music from the CD player powered by the SHS. Previously, he used candles and kerosene for lighting. The price of kerosene kept rising, he suffered from bouts of bronchitis because of the fumes, and suppliers would sometimes adulterate the kerosene with petrol. The SHS eliminated those problems for him (Kumar and Sadeque, 2012).
- Since Hajra, a mother of four, received the SHS 2 years ago, she has been able to power five lights, a TV, and a mobile phone charger. Previously, she used kerosene and still remembers the fumes that filled her house. Now her children can study in the evenings and she can charge her mobile phone to keep in touch with her husband, a laborer in southwest Asia (Kumar and Sadeque, 2012).
- Mustafa, who owns a barber shop, used to borrow power from his neighbor's side connection. He paid 200 Tk/month but had no control over how much power he would receive,

for how long, or when. The SHS, installed 13 months ago, has changed his quality of life and his business for the better. His hours are flexible, and he can close the shop as late as 9 pm (Kumar and Sadeque, 2012).

Role model for replication around the world

Following the success of IDCOL SHS program, a number of countries from all over the world are interested to replicate the model in their respective countries. Considering the huge demand in international market, different countries, i.e., Ethiopia, Ghana, Sudan, Guinea, Sub-Saharan Africa, Uganda have been provided corporate advisory services on rural electrification and renewable energy program implementation. More than 60 senior government and private sector officials were trained under such workshop.

Way forward to the future

To ensure commercialization and sector sustainability, the subsidy element will be gradually withdrawn from the program and stricter credit terms will be imposed. The capital buy-down grant to the household and institutional development subsidy to the POs have already been reduced to zero except for the smaller systems sold to the poorer segment of the society. One possible

challenge that the program may face in near future is the competition from suppliers with poor quality SHSs who may enter the market given its future growth potential and create a price pressure. Major obstacles, among others, include lack of confidence of commercial banks to finance small RE initiatives and unavailability of adequate technical manpower and penetration of low-quality equipment and appliances.

According to a study titled "How the Sun Powers: An Evaluation of Institutional Effectiveness and Impact of Solar Home Systems in Bangladesh" undertaken by Bangladesh Institute of Development Studies in March 2013, the potential market for SHSs in Bangladesh is about 6 million. With growing per capita income and reducing trend of SHS prices, the potential market size is likely to increase in future.

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