Tackling weaknesses in the Solar Home System (SHS) market in Bangladesh

Enian CELA
Ph.D. student
Graduate School for International Development and Cooperation, Hiroshima University,
1-5-1 Kagamiyama, Higashi-Hiroshima, 739-8529, Japan
E-mail: eniancela@hiroshima-u.ac.jp

Partha Pratim GHOSH
Information Management Specialist
Global Communication Center, Grameen Communications
9F, Grameen Bank Bhaban, Mirpur-2, Dhaka-1216, Bangladesh
E-mail: partha1975@gmail.com

Eusebio Villar ANGARA
College President
Aurora State College of Technology
BrgyZabali, 3200 Baler, Aurora, Philipplines
E-mail: seb.angara@gmail.com

Peng ZHANG
Post Graduate student
Department of Traffic Engineering, Beijing Jiaotong University
No.3 Shang Yuan Cun, Hai Dian District, Beijing, P.R. China
E-mail: 10121085@bjtu.edu.cn

TUSWADI
Graduate Student
Graduate School for International Development and Cooperation, Hiroshima University,
1-5-1 Kagamiyama, Higashi-Hiroshima, 739-8529, Japan
E-mail: tus5800@yahoo.com

Zhou YANG
Graduate Student
Beijing Normal University
No. 19, XinJieKouWai St., HaiDian District, Beijing 100875, P. R. China
E-mail: rain_rr10@163.com

Abstract

In the last decade, the Solar Home System (SHS) market in Bangladesh has been rapidly expanding. Presently, the market reflects enormous potential but is, at the same time, prone to various weaknesses and risks. In this paper, we address the already identified (in the literature) weaknesses and risks in terms of advancing solutions to tackle them. Namely, we examine weaknesses associated with quality, sense of ownership and funding. The analysis does not include an empirical approach but rather employs supportive evidence to justify the advanced solution proposals.
Keywords: SHS, weaknesses, risks

1. Introduction, general information and objectives

1.1 Introduction

Solar photovoltaic (PV) and other renewable energy technologies are often referred to as being the sources of future generations. A possible scenario was drawn with solar energy covering nearly 30% of global energy demand by 2050, and nearly 70% by 2100 (IDCOL, 2011). In fact, during recent years improved technologies and decreasing prices have resulted in manifold applications of SHS: for small-scale purposes such as the decentralized powering of emergency telephones on motorways or in large solar power plants.

In the last decade, the use of SHS for electricity supply in rural households of developing countries has been increasingly promoted by international development organizations, especially in places where the extension of national gridlines was not an economically viable option. The case of Bangladesh constitutes a good example for this development. Bangladesh belongs to the group of 50 Least Developed Countries identified by the United Nations (UN-OHRLLS, 2011). Aiming at the promotion of sustainable development through the increased use of electricity in rural areas of Bangladesh, more than 1,000,000 SHSs have been disseminated through a program funded by the World Bank, Global Environment Facility (GEF) and the German 'Kreditanstalt für Wiederaufbau' (IDCOL, 2011).

To supply electricity with quality light, reliable service and long term sustainability, the solar energy system is considered as an important emerging option by the policy makers (World Bank, 2004). The system would not only provide reliable, clean and environmentally friendly energy, but could also create employment opportunities in the vicinity of its operation.

Bangladesh has a low electrification rate, in that only 41% of households have access to electricity (IEA, World Energy Outlook, 2011), whilst in the rural areas, 75% of the population does not have access to electricity. The sector suffers from acute problems of inadequate power generation capacity and lack of distribution infrastructure, although the country has been making great efforts on grid expansion in rural areas by establishing rural electrification cooperatives (Taniguchi and Kaneko, 2009).

Around 88% of the country's electricity generation currently draws on domestic natural gas (Bangladesh Bureau of Statistics, 2011). However, Bangladesh's domestic gas reserves may be exhausted in the near future if no new gas field is discovered. The high investment required to extend the national grid to isolated and rural areas is an impediment to extending the supply of grid-based electricity to additional rural areas. Promotion of decentralized electrification based on renewable energy, especially solar PV systems, can be an effective alternative for supplying electricity to off-grid regions in Bangladesh. According to the Renewable Energy Policy of Bangladesh, published in 2008, renewable energy is recognized as having strong potential for delivering electricity services to the entire country by the year 2020 (Government of the People's Republic of Bangladesh, 2008).

Beginning from January 2003, Infrastructure Development Company Ltd. (IDCOL) has brought more than 1,000,000 rural households under the solar power system. IDCOL is implementing this program with financial assistance from the World Bank, ADB, IDB, GEF, GIZ, CIDA and KfW. A total of 30 partner organizations (POs) are disseminating solar home systems in the remote rural areas of Bangladesh under IDCOL's renewable energy program. The market share of POs are shown in Figure 1.

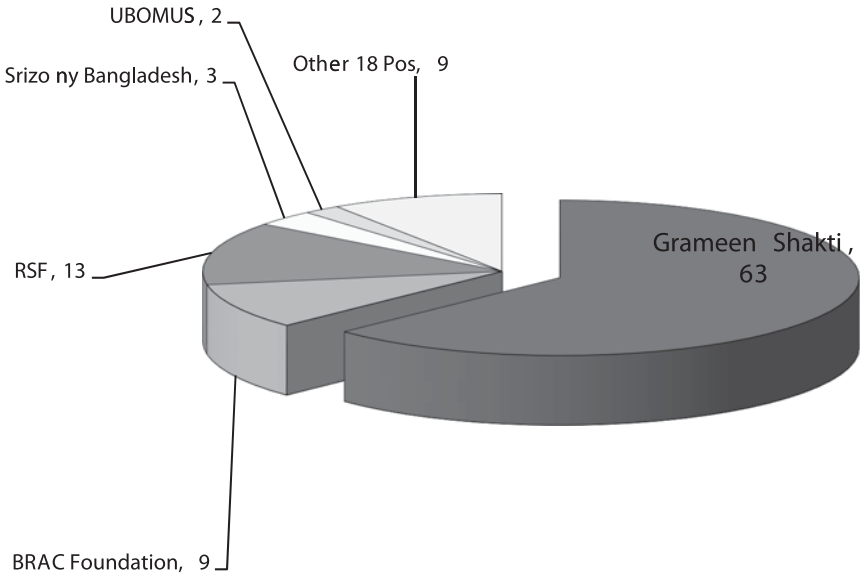

Figure 1: Market Share of SHS distribution: IDCOL 23 POs(%) (IDCOL, 2011)

Under this program the POs purchase the SHS packages in advance and sell them to the customers. Upon reaching an agreement with the customer, the POs fulfill the contract to the IDCOL and IDCOL covers 80% of the cost. Therefore the financing occurs after the package sale to the customer and the POs cover 20% of the cost with their own funds (IDCOL, 2011).

1.2. Solar electricity and its prospects, weaknesses and risks in Bangladesh

Bangladesh, as a developing country, has the lowest rate of electricity, standing at only 55% of the total population. In the rural areas of Bangladesh, where 75% of the population lives, electricity deprivation is perceived as very serious (Bureau of Statistics, 2011). Due to resource limitations, it appeared to be difficult and expensive to provide electricity only utilizing commercial energy sources. Research evidence indicates that different sources of renewable energy could be the viable alternatives for supplying electricity and could bring huge benefits for the rural people (Ahammed, 2004). Renewable energy is environmentally sustainable, socially acceptable and an economically viable option in the off-grid locations (Islam, 2001; World Bank, 2004).

Islam (2005) reviewed the policy formulation and institutional development process for harnessing renewable energy sources in Bangladesh, and critically evaluated both the Draft National Energy Policy-2004 and the Draft National Energy Policy-2006. In this article, the various barriers that prevent the expansion of the SHS market are categorized as: policy-related, institutional, economical, informational, technical and human resource-related. In particular, the author indicates the information problems associated with a deep information asymmetry engulfing the market. Hiranvarondon et al. (1999) suggested that dissemination of solar energy systems requires an implementation strategy that should initially identify the type of system. The government could accelerate dissemination by removing barriers to market expansion, excessive duties and taxes, and subsidies on products which compete with solar systems. They also listed the role of key players involved in the promotion of dissemination of solar systems in developing countries as national governments, donor agencies, educational and research institutions and private sector (POs).

Urmee and Harris (2011) identify several weaknesses and risks affecting the SHS market in Bangladesh. Among the weaknesses, the authors identify:

- Difficulty in obtaining loans
- SHS design and low quality components
- Lack of policy and government support
- Lack of managerial training
- Lack of sense of ownership on the part of customers

The risks include:

- Non-performing payments
- Increasing equipment costs
- Increasing transportation costs
- Natural disasters

Difficulty in obtaining loans is due to the fact that the program is mainly funded from donor organizations (GIZ, World Bank, ADB), reflecting serious fund limitations. These limitations disallow the purchase of a larger numbers of packages inhibiting the future expansion of the market. Additionally, the market is characterized by the introduction of low quality components in particular: battery chargers and package-lights which reflect poor performance in many cases (Urmee and Harris, 2011). These circumstances, coupled with certain problems associated with assembly (panels are assembled on top of roofs made of laminate and other slippery material or on top of standing bamboo trees), increase customer annoyance, producing a feeling of non-ownership. That is also reflected in non-performing payments on the part of the customers (Urmee and Harris, 2011).

The lack of managerial training is reflected in the desperate need for technical and managerial staff. Therefore, even though the market expands, the human resources necessary to support this expansion are seriously lacking. Furthermore, SHS expansion is not properly covered in the national General Energy Policy and Renewable Energy policy. As a matter of fact the bulk of investment goes primarily toward capacity building and grid dissemination.

1.3. SHS Packages and prices

A solar home system (SHS) is a complete package set including the following:

- Solar panel with frame
- Battery (storing electricity)
- Charge controller (preventing excess charging and excess discharging of the batteries)
- Necessary plugs, sockets, cables, fuse for the package
- Lights (suitable for solar power system)
- TV, mobile charger (optional)

The customer can choose to pay the price upfront in cash and receive a 4% discount. The other options include a down-payment of 25% with the remaining amount to be paid in 2 or 3 year monthly installments at interest rates of 4% and 6% respectively. Prices for the different SHS packages are shown in Table 1:

Table 1: Purchasing prices of SHS packages in Bangladesh (source: IDCOL, 2011)

Package options	Content	Operating Hours	Cost (in USD)
20Wp	Lamp: 2 (5W each) Mobile Charger: 1	4-5 hours	170
40 Wp	Lamp: 3 (6W each), Mobile Charger:1, BW TV: 1	4-5 Hours	280
50Wp	Lamp: 4 (7W each) Black & White TV: 1 Mobile Charger: 1	4-5 hours	380
85Wp	Lamp: 9 (7W each) Black & White TV: 1 Mobile Charger: 1	4-5 hours	580
130Wp	Lamp: 11 (7W each) Black & White TV: 1 Mobile Charger: 1	4-5 hours	940

Warranty periods of SHS accessories are as follows:

- Solar Panel: 20 years
- Battery: 5 Years
- Lights: 1 year
- Charge Controller: 1 year
- After sale service (maintenance and reparation) provided by the PO-service provider: 3 years (free), after 3 years a customer can renew a year-round service package with some cost.
- No warranty
- Principally, the packages provided in the market are same across all POs.

1.4. Objectives

While the weaknesses and risks are identified in the existing literature, ways to tackle them are not. In this paper we propose several measures to address 3 weaknesses:

- SHS design and low quality components
- Lack of sense of ownership
- Difficulty in obtaining loans

The purpose of this paper is not to make proposals based on deep and detailed analysis of the measures including induced or non-intended effects that could surface from their application. Moreover, we are not going to set a sophisticated empirical methodology to support our proposals. The measures are proposed based on common-sense judgment. Naturally, deeper analysis is required for actual application, including estimate of impact, costs and induced effects. Such analysis is not the objective of this paper.

2. Tackling weaknesses

2.1 Tackling design and low quality component problems

As mentioned in the previous section, low quality equipment is found throughout the Bangladeshi market and it is very difficult to differentiate low quality from medium quality and high quality. In all cases, one purchase price characterizes the market. The only question is: how can the customer identify what he/she is buying. The answer is: he/she cannot. Poor knowledge on the matter coupled with a deep information asymmetry makes the identification process impossible. Under these circumstances, a guarantee of quality must be achieved elsewhere.

In the case of Bangladesh, considering that the country predominantly imports all components of the package, control can be achieved at customs points. After the central government enacts the production standard, the customs authority can carry out the control procedures and allow only components belonging to a central quality level to enter into the country. Components that do not meet with the established standard are to be banned and declared as outlaw.

Another possible solution is through market-based instruments. Presently, the government sets a 5% customs duty for solar modules, regardless of type (high quality or low quality). An alternative would be the application of a differentiated rate: a higher rate in the case of low quality components and a lower or zero rate for high quality components. This would help create a price incentive (especially if low quality components have cheaper import prices compared to the high quality ones) and stimulate a shift towards medium and high quality components. However, changes in taxation components could have possible induced effects calling for careful consideration and calculations at the moment of application.

As mentioned in the previous section, a potential reason for low quality penetration is the information asymmetry associated with a large number of suppliers (import suppliers). Even though healthy competition is considered positive for market improvement, under conditions of information disparity, potential rent-seeking behavior occurs, making the competition itself dishonest. In this case an alternative approach to the competitive market is suggested: selective intervention. Under selective intervention (Stiglitz, 2001), the government intervenes to correct market imperfections associated with information asymmetry and rent-seeking behavior, producing a situation of rent guaranteeing. When the profits are guaranteed to meticulously selected operators (suppliers), economic integration and economies of scale materialize, producing positive consequences in terms of quality and prices.

In the particular case of Bangladesh, the information asymmetry is associated with the large number of suppliers.

Reducing the number to a few or possible one large supplier would be a most desirable condition. The process of selection of the supplier could be achieved by means of international procurement with the assistance of a consulting mediator. In the terms of reference, higher emphasis could be placed on price and quality of the equipment with the concession contract not to exceed a certain number of years (3-5). Determining the price at the very beginning would prevent the supplier from taking advantage of the situation and behaving like a monopolist. At the same time, contractual limitations would allow for price changes in the future considering that positive developments are foreseen in the field of SHS (especially in terms of production cost reduction).

The existence of a single supplier would improve the information flow, increase promotion capability and eliminate market inefficiencies. There are, however, certain risks associated with selective intervention. First, the intervention should not be permanent. Gradually, as the information flow and the market monitoring capabilities improve, a transition towards competitive conditions must be guaranteed. Long term selective intervention tends to produce gigantic deformations in the market. A second risk is associated with the possibility of a biased choice of supplier as a result of bribery and corruption. In order to keep the process "clean", the international nature of the process and the consulting agents come into play to guarantee process transparency.

Selective intervention is intangibly apparent in Asian countries. We can mention the case of the Republic of Korea (Noland, 2004), where selective intervention produced an improvement in general industrial formation and elimination of externalities. Paldam (2003) analyzes the success of East Asian Tiger economies, focusing on the role of government and the laissez faire conditions. Once again it is pointed out that government intervention was temporary and very selective. Later on, laissez faire conditions took over.

2.2. Tackling lack of sense of ownership

Poor sense of ownership comes as a result of, firstly, the customer deliberately behaving recklessly, and secondly, of the customer behaving carelessly as a result of annoyance (annoyance as a result of poor assembly of equipment). In the first case, the POs could continue to implement awareness raising commitments. In the second, standards of assembly need to be improved. Equipment placement in dangerous and/or non-accessible locations has to stop. When a certain level is reached, the POs could be justified in pursuing more radical action in the case of deliberate reckless behavior, such as warnings or even specifying in the initial contract the reserved right (of the PO) to retrieve the package should the customer be found non-compliant with maintenance clauses. Certainly, such clauses should be clearly determined in the contract. At the same time, the contract should include a provision that anticipates frequent and unannounced inspections at household sites for verification of the working conditions of the package.

2.3. Tackling the funding problem

It is not a coincidence that we left the funding problem for the end. As a matter of fact, the Bangladeshi market of SHS is in desperate need of funding. Most of the financing comes from donor organizations and such sources have limited capacities. Therefore, what are possible alternative sources of financing?

First, the government itself could and should allocate resources to the SHS expansion program considering the present difficulties of grid integration of the rural areas. However, one must be realistic regarding the budget constraints of the government. Limitations aside, the financing is mostly dedicated to the generation of energy and grid expansion fields. At the moment, it does not seem that the government is very much in a position to support SHS.

The commercial banks operating in Bangladesh have been rapidly expanding their operations in the last years. Presently, 35 commercial banks operate in the country (Bangladesh Central Bank, 2011). The investment portfolio is concentrated primarily in the fields of oil and gas, energy, transportation and shipbuilding. SHS has received little attention due to poor information coverage. Improved market structuring (a consequence of selective intervention) could facilitate the information distribution flow and make the sector attractive to the commercial banks. Additionally, in the country there are 9 operating foreign commercial banks including Citibank and HSBC (second largest banking and financial group according to Forbes, 2011). Should the government define the SHS as a strategic sector, the interest of commercial banks would also increase and investment might flow into the program. Funding could also be provided by non-bank investment groups. In Bangladesh there are already powerful investment groups from the Middle East including Saudi Arabia and United Arab Emirates (investments primarily focused on oil and ship building).

A potential source of financing could be the Islamic financial organizations and Bangladesh is eligible as a member of the Islamic Conference. Recently the Islamic Bank granted a long-term loan at zero -interest rate to Kosovo (27 million USD) to be

spent on health, education and infrastructure (Balkan Insight, 2011). Other organizations like OPEC and the Arab Fund also provide loans. Furthermore investment groups like Kharafi, Fly Emirates, Etihad etc. are increasingly providing international loans for projects. In general loans coming from Islamic financial institutions incorporate interest rates and installment conditions that are much more favorable compared to other international financial institutions and banks. All that is required is loan recipients: projects.

Even though the investors are there, they still do not invest. The reason is that the Bangladeshi government needs to pay more attention to the SHS market. For starters, a better collocation in the general Energy Policy and Renewable Energy policy is necessary. Additionally, better lobbying is required both within the country and in the international organizations where Bangladesh is represented. Despite the fact that the market has high potential, it is still not well known and poorly researched.

3. Conclusions

In this report we have advanced several proposals to address certain weaknesses characterizing the SHS in Bangladesh. Namely we have tackled the weaknesses relating to quality, sense of ownership and funding. Amongst the measures proposed, we must emphasize the need for a more structured market that would close informational asymmetry gaps, improve market knowledge, increase SHS attractiveness to potential investors and enable the introduction of high quality and low price equipment to the market. POs on the other hand have to do more in improving the standard of assembly.

Additionally, alternatives were indicated in terms of potential loan sources. As government budget constraints inhibit larger financial involvement in the SHS market, domestic and international banks and also non-banking investment organizations are possible funding sources. Particularly, Middle-East financial and investment organizations provide sufficient lending coupled with very favorable interest rates and installment options.

Although this report focuses mainly on specific proposals, a well-thought out and well-integrated government dictated policy is crucial. The present policy on renewable energy only marginally touches on the SHS aspect, which is surprising considering that the market represents a success story not only at the domestic but also the international level. Therefore the situation has to change. Considering budget constraints, the government could begin with fiscal incentives and better investor lobbying for the present. In the longer term, a new policy should address the issue, proposing investment projects and enhanced stimulation measures.

References

Ahammed, F. (2004). *PV Micro-Utility Model in Gha-Chulka Cannel Bazaar.* Bangladesh Renewable Energy Newsletter, 1 (2)

Balkan Insight (2011). Retrieved from http://www.balkaninsight.com/en/article/kosovo-to-get-loan-from-islamic-banking

Bangladesh Central Bank (2011). Retrieved from www.bangladesh-bank.org

Bureau of Statistics (2011). *Preliminary report on household income & expenditure survey-2010.* Bureau of Statistics, Bangladesh.

Forbes (2011). Retrieved from www.forbes.com/global2000/

Government of the People's Republic of Bangladesh (2008). *Renewable Energy Policy of Bangladesh*. Ministry of Power, Energy and Mineral Resources, Bangladesh.

Hiranvarondon, S., Hill, R., and P. O'Keefe (1999). A Strategic Model for PV Dissemination in Thailand. *Progress in Photovoltaics Research and Applications,* 7, 409-419

IDCOL (2011). Retrieved from www.idcol.org

IEA (2011). *World Energy Outlook.* Paris, France: IEA

Islam, M. (2001). *Investment Opportunities for Renewable Energy Technologies in Selected Countrie.*, Germany, Oldenburg: Internal Report for EBV Group of Companies

Islam, M. (2005). *Renewable energy in Bangladesh and Government Policy, Solar Photovoltaic Systems* in Bangladesh—Experience and Operations. Bangladesh Center for Advanced Studies.

Noland, M. (2004). *Selective Intervention and Growth: the case of Korea.* IIE Working paper 04-3

Paldam, M. (2003). Economic freedom and the success of the Asian tigers: an essay on controversy. *European Journal of Political Economy,* 19, 453- 477

Stiglitz, J. (2001). *Globalization and its discontents.* New York, NY: W.W. Norton and Company

Taniguchi, M. and S. Kaneko (2009). Operational performance of the Bangladesh rural electrification program and its determinants with a focus on political interference. *Energy Policy*, 37, 2433-2439

UN-OHRLLS (2011). *Least Developed Countries.* New York, NY: UN

Urmee, T. and D. Harries (2011). Determinants of the success and sustainability of Bangladesh's SHS program. *Renewable Energy,* 31 (11), 2822-2830

World Bank (2004). *World Bank Energy Indicators.* Washington, DC: The World Bank